Designing **Climbing** Guides for Mobile **Devices**

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Abstract

Due to the rapid technological development of mobile devices in recent years, cell phones now support a far broader range of usability than simply calling and sending text messages. Technologies that were previously unique to numerous individual handheld devices – such as cameras, video recorders, geographic location devices, touch screens, altimeters and Internet – are now converging and becoming commonplace to one single device. This is providing a foundation for new ways of combining media that has been enabled by these technologies.

Within the context of mobile computing, the possibilities of incorporating and combining different technologies together in a media product provides a vast range of new aesthetics, and new media genres are emerging due to the many ways we interact with media in the different contexts of our everyday life. This thesis examines how new media technology on mobile devices can be used in a beneficial way within a specific context.

Using standard climbing guides as a reference, I seek to provide a greater understanding on how technological features unique to the mobile media platform can support a meaningful user experience in a classic setting. The technological features discussed in this thesis are hypertext, multimodality and location-based services.

Acknowledgements

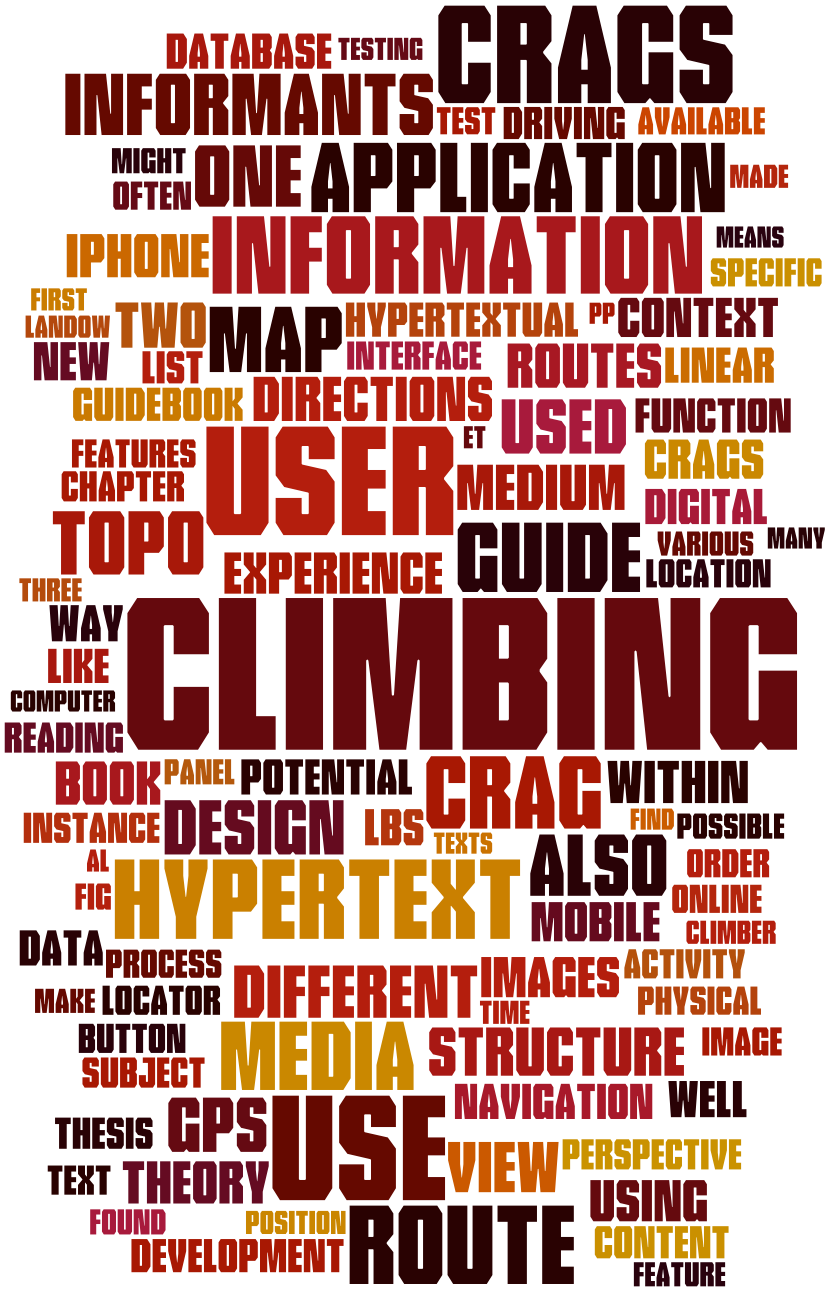
The smallest act of kindness is worth more than the grandest intention.

~ Oscar Wilde

During the three years of this thesis there have been laughs and there have been moments of banging my head against a wall. I need to thank the people around me; for making me laugh as well as for supporting me when my head has been aching.

I would like to thank my supervisor Gunnar Liestøl (Autumn 2008 – Spring 2011) for comments, patience and support. I would also like to thank my informants who were gracious in giving their valuable time for this project.

Finn and Matt, thank you for proof reading. Richard Walker, thank you for your kindness, time and insights. To the students around me: thank you too. To friends and family who support me in various ways, you are not forgotten: thank you. Last and most important I must thank Vegard Fleischer Orkelbog. For our talks and ponderings, excursions, lunches, for your positive attitude, for listening to me and for your support: thank you so much.



Word cloud of the 100 most used words in this thesis.
Courtesy of wordle.net

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1 Introduction

This master's thesis seeks means to understand how properties of emerging technologies, in the comparative perspective of adaptation of media, can support a richer user experience[1] within a specific context of use. Originating in the context of a practical/theoretical master's thesis, a climbing guide has been prototyped as an object for scientific enquiry, which I hope will reveal aspects applicable to a broader context of adapting content to mobile media devices.

The process of transferring media content from one medium to another is described as a process of adaptation. More specifically, adaptations can be executed according to different strategies. While still attempting to maintain faithfulness to the original medium and its aesthetic, this process of adaptation is one that recognises the need for the *transformation* of media content to a new medium. In contrast, alternative strategies to the transfer of media content are for instance *transcription* – where faithfulness to the original is overarching – or *assembly*, an aesthetic more fragmented, collage oriented and distant from the original medium (Kress and Van Leeuwen 2001, p.102).

Driving forces in the evolution of mobile media such as advances in hardware technology and competition among the manufacturers of mobile devices has resulted in smart phones becoming increasingly more packed with various hardware features and improved processing power. The evolution of media content is only one step behind, and developers are eager to utilise the new possibilities at hand. The resulting digital texts are more diverse, feature rich and complex in their aesthetic. This salient trait in the evolution of digital media is described as dynamics of convergence, which in turn leads to divergence[2], as exemplified by the plethora of rich media applications for mobile media we see being developed today.

Enquiries made on emerging technology such as high-end smart phones, executed in a manner of production/interpretation, are not subject to any established theoretical field, at least not in the humanities. Thus, the theoretical frameworks used in this

[1] *User experience*, a term widely used in interaction design, refers to "how a product behaves and is used by people in the real world [...]. More specifically, it is about how people feel about a product and their pleasure and satisfactions when using it, looking at it, holding it, and opening or closing it." (Sharp, Rogers et al. 2007, p.13)

[2] See for instance *The Dynamics of Convergence & Divergence in Digital Domains* (Liestøl 2007)

thesis are composite. Media theory with respect to the subjects of hypertext, modalities and the rhetoric of new media, contextualize and highlight the dynamics at play when adapting media content. The field of human-computer interaction is relevant both for discussing the development and as a framework for measuring the qualities of the technological features implemented. Derived from its Russian origin within psychology, activity theory has found a broad appliance in a diversity of theoretical fields, and is useful for relating media objects to contexts of activity and location, which both are highly relevant for the mobile media developer.

As George Landow remarks, "theorizing promotes innovative, effective use of digital information technology by helping us understand those aspects of it that significantly differ from that with which we are already familiar"(Landow 2004, p.36). Besides being a relevant claim for anyone involved in processes of adaptation to emerging media, it marks the outset of this thesis. From my theoretical background within media science, I started prototyping a digital climbing guide focusing especially on significant differences to the old medium. These significant differences were subjectively identified as hypertext, multimodality and location-based services. I then commenced a user test to acquire data on the possible potential inherent in these differences, before writing up my findings and the thesis. The process of knowledge production as a whole has largely been a circular hermeneutic one, reflecting the processes of iterative interaction design.

The remainder of this chapter will give detail to the origins and the structure of a climbing guidebook. Chapter two will describe the development, present the application in general and focus on some of the more unique features developed. Chapter three will serve as a theoretical backdrop, both for my focus on the unique properties of the medium and for crucial aspects relevant to application design within mobile media. In chapter four I will discuss the user test and the findings that emerged from it. Finally, in chapter five I will summarise findings, discuss future development and outline the thesis' limitations and applicability in a broader perspective.

1.1 The history and use of climbing guides

In order understand the purpose of use and the contexts of use of climbing guides, a brief glance at history will provide insight. There are many forms of climbing; sport climbing, aid climbing, traditional climbing, bouldering, ice climbing and so on[3]. However, climbing guidebooks are in certain ways uniform, and can be divided into two categories. One is a guide that details aspects of one or several specific climbing styles, the other is a guide to where such climbing can be found. The former typically includes information about what gear to use, how to use and maintain it, climbing techniques, and physical and mental aspects of climbing. In short a lexicon of a specific type of climbing. The latter type, which is focused on in this thesis, will often also have a section that covers some of these aspects (typically the introductory chapters of the book). However, their main purpose is to serve as guides to locating already known climbing routes within a geographical area.

Their function as a source of information can be exemplified through a broader historical context, before the use of books in this field. Like many historical enquiries, it is hard to pinpoint an exact origin for the activity of climbing. However, in this frame of reference, the Golden Age of Alpinism is a natural point of departure. Between 1854 and 1867 alpine clubs were formed. Most peaks in the Alps were conquered, and climbing became increasingly popular with scientists and others. According to Ronald Clark, the main reason for this increase in alpine activity was that the scientists had to climb regularly, in order to obtain answers to their questions.

> It was necessary for them to be out and about not only in fair weather but in the full blast of the mountain storm; it was necessary for them to camp, to train and hire guides who could carry their delicate instruments with some approach to safety, to build up a technique of travel above the snowline and to produce a demand for better inns below it. The men of science acquired, in order to keep both their scientific wits about them and their lives intact, the first rules of mountain travel. (Clark 1953, p.20)

And with the increase in climbers and climbing activity, came also the training of guides. Early on, local peasants were brought along for their knowledge on local matters like lowland topography and reading the weather conditions, “yet the whole virtue of these men was that they could lead others across mountains rather than up them; they would look, instinctively, for the nick in a skyline rather than for the ridge

[3] For further information on the different types of climbing, a good introductory overview is listed on Wikipedia (Wikipedia 2011b)

that led to a summit"(Clark 1953, p.88). Early alpine pioneers like C. E. Mathews helped raise the first number of peasants into the profession of mountaineering guides. These people became a source of *local* knowledge relevant to reaching the summit (Clark 1953). In relation to our modern day climbing guidebooks, the alpine pioneer was the equivalent of the lexical guidebook while the former peasant and local guide was the equivalent of the geographically oriented guidebook.

As the above description details the concept of guiding within mountaineering, there is not an easily traceable line from guiding in the early mountaineering era to the guidebooks of today. In writing this chapter, I found a lack of literature on the subject of the history and development of climbing guidebooks. This led me to search for information within the evolution of mountaineering, the activity presupposing such books. In efforts to find more information on the subject matter, I came in contact with Joseph Taylor Ph.D. at Simon Fraser University. His article *Mapping adventure: a historical geography of Yosemite Valley climbing landscapes* (Taylor 2006), looks at the development of rock climbing in Yosemite Valley in relation to the development of climbing guidebooks. My initial theory was that it was possible to trace a line from the early use of local guides and cartography up to the guidebooks of today. Taylor dismissed this by explaining that the evolution of mountaineering was too fragmented for supporting such a hypothesis (see appendix 1). Information from him as well as from my own research, made it clear that there exists no seminal bibliography on the global evolution of mountaineering. Bibliography often employs a local focus such as The Swiss Alps, British Mountaineering or the Yosemite Valley. Therefore, in order to provide some background for the existence of the

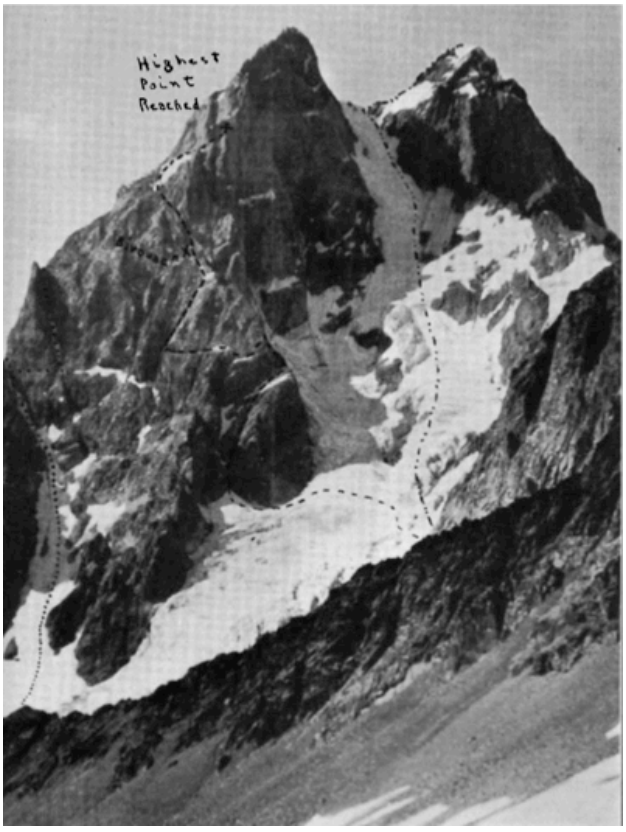


fig. 1: Early topo of Mt. Ushba in the Caucasus Range. American Alpine Journal 1 (1931), Courtesy of Edith Overly and Jay Taylor

modern day guidebooks, key elements from a variety of sources detailing the history of mountaineering will be highlighted.

Arguably, the aforementioned alpine clubs had a major impact on the evolution of mountaineering. These clubs formed rules, methods and conventions on mountaineering, and they also gathered and published information on climbing routes. For instance, the introduction of *topos*, a graphical representation of the routes ascended, came with the first published stories about climbing (see fig.1)[4]. The journals published by the alpine clubs were early examples of such articles. Another notable moment in history is the establishment of rock climbing as a sport, thus separating itself from the activity of mountaineering. This happened in the 1880's in Great Britain, Germany and Italy (Kidd, Hazelrigs et al. 2009, p.4). The introduction of grading systems was another important component for the modern guidebook, with distinctions made to communicate the difficulty of the climb. Willo Welzenbach was the first to introduce a grading system in the 1930's (Connally 2005, p.73). Finally the introduction of sport climbing as a climbing style had a major impact on the formation and development of climbing crags, again affecting the guidebooks. Traditionally, climbers would place protection[5] in cracks in the rock face, onto which a rope was then tied in to secure oneself during the ascent. In the 1970's, French climbers began drilling bolts into the more featureless parts of walls, where no traditional protection placements were possible (Bisharat 2009, p.28). Climbing on bolts was labelled sport climbing, which undoubtedly led to the widespread formation of climbing crags by making it possible to have a high density number of routes within a small geographical area.

Eventually, from the earliest route descriptions to modern day publications, climbing guidebooks have become a vital source of information in locating climbs as well as for giving information on route conditions, climbing difficulty, the equipment needed and more. Even though they are as useful in a planning stage at home as in the field, they are nevertheless concerned about location, often seeking to answer the reader's questions in a locative context. The topo, as a highly central feature of the climbing guide, underscores the importance and relation between locative orientation and the function of guiding in the activity of climbing. The place-centric character of guiding

[4] According to Jay Taylor through e-mail correspondence, see appendix 1.
[5] Protection is a general term for equipment used to secure the climber to the rock.

within climbing is emphasized by the Greek etymological origin of *topos,* meaning *place* (Oxford English Dictionary 2011b).

Climbing guidebooks are as stated above quite uniform in their structure, however, it is important to emphasize some differences as well. The structure of climbing guidebooks is heavily influenced by the geographical conditions of the area in question. Thus, a climbing guide to big mountain walls in Jotunheimen has a different structure than that of a climbing guide to crags around Oslo. The latter has a more uniform structure, mainly because it is covering a smaller geographical area describing more similar geographical conditions. The guidebooks on climbing crags are the subject for adaptation in this thesis, and brief introduction into the structure and various components of a climbing guide will be necessary to further discuss the adaptation of the guide to the mobile device.

1.2 The structure of the climbing guidebook

Typically a climbing guide is sectioned into *crags*. Although a crag literally means "a steep or rugged cliff or rock face"(Merriam-Webster), in climbing terms it refers simply to an area of climbing[6]. In a guidebook, each crag section usually includes an introductory chapter with a map showing how to navigate to the crag by road, as well as an approach map for walking directions from the nearest parking. These maps are often complemented by written instructions. It is also commonplace to provide charts that give an overview of the number of climbs, the distribution of different climbing styles[7], and the grades they have. After the introductory section, the crag is then divided into walls.

Each wall consists of one or more topos, which might be a sketch of the wall enhancing salient features like trees and rock features (fig. 2), or an actual photograph where the routes are marked as an overlay on the image. The most common way to link to route information displayed on the topo is by using a number indicator on the image, which then refers to a route description below. This layout is

[6] A steep rock face is a prerequisite for climbing; the definition's deviance from its use within climbing is not far. In climbing terms a crag is an area with a rock face, or several closely situated rock faces, that are especially developed for climbing.
[7] There is often a mix of styles, or types of climbing within a crag, typically bolted, traditional and mixed routes.

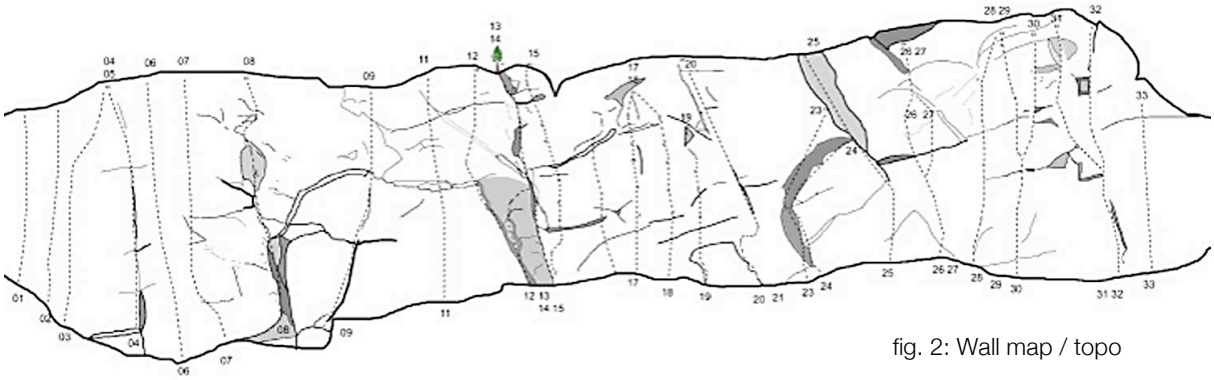


fig. 2: Wall map / topo

not entirely consistent for all climbing guides[8], but forms a general convention on the structure (fig.3). Lastly, another mentionable element in the guidebook is the use of photos, which have the purpose of inspiring the reader and decorating the guidebook.

The figures on the following pages (fig. 4-8) provide an example of the crag structure and the corresponding layout in the climbing guidebook *Drammensgranitt (Bordevik and Drammen Klatreklubb 2009)*, complete with descriptions of the various information elements. Having then detailed the historical background and the structure of the guidebook, I will move on to describe the application Crags, its structure and implementations of the aforementioned elements, as well as the features unique to the application.

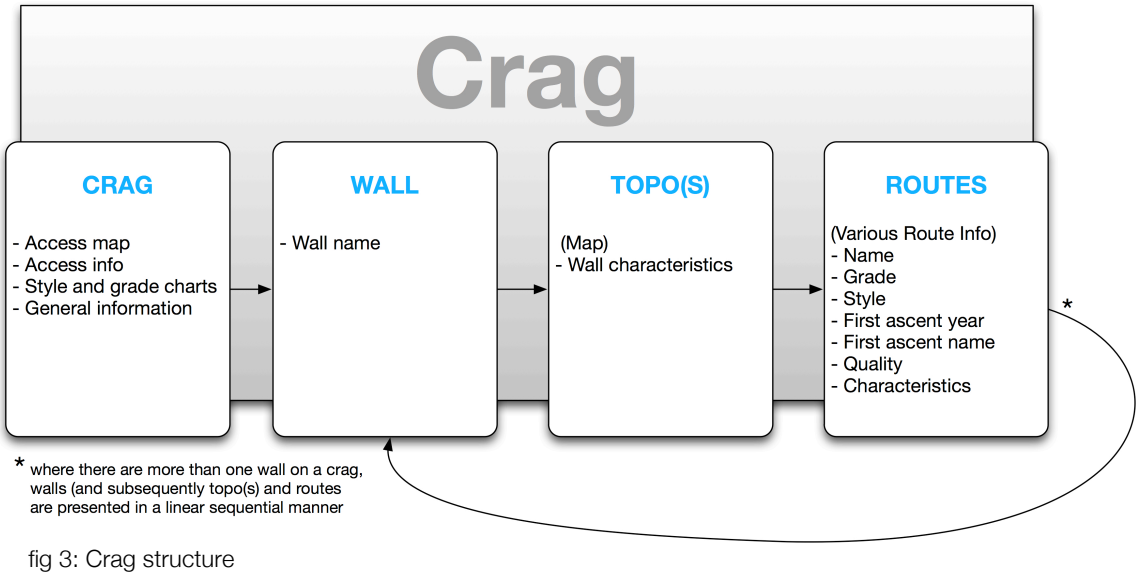
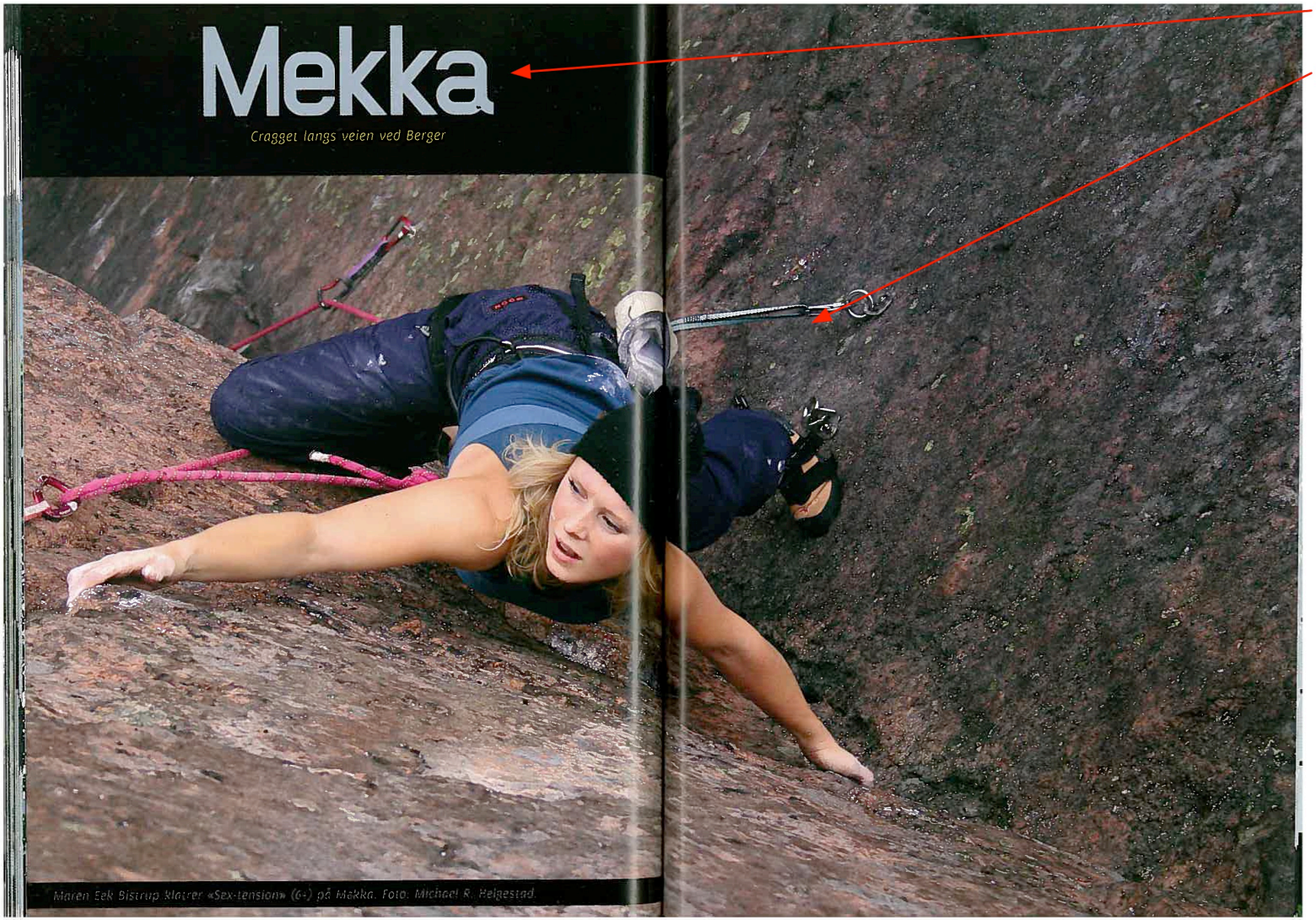


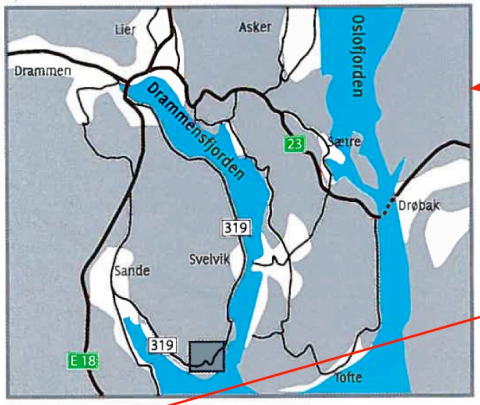
fig 3: Crag structure

[8] For instance, some crags operate with *sectors*, each containing walls, wall maps and routes.



1. Crag

2. Inspirational picture



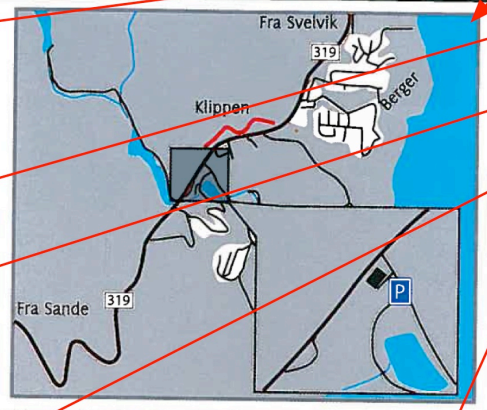
Mekka

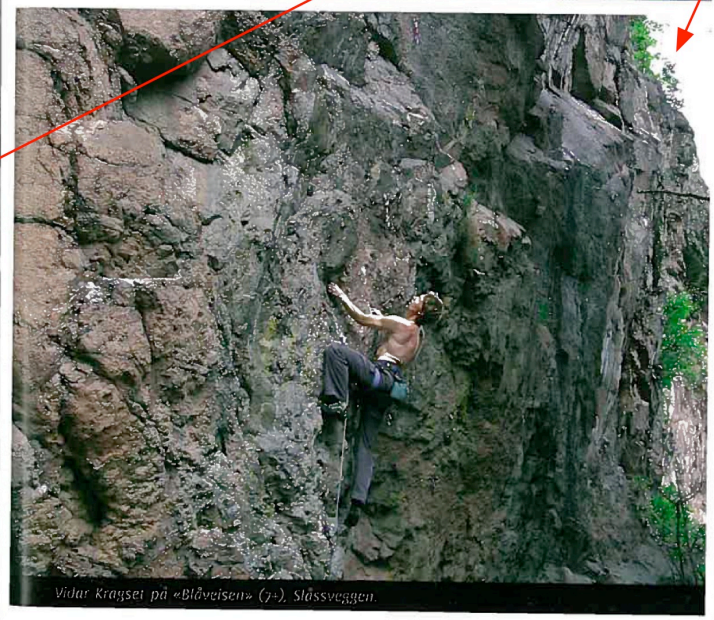
Ved Berger finner du en mektig klippe beliggende rett ved veien. Generelt kan det sies at denne klippen byr på himmel og helvete med hensyn til kvalitet på rutene. De beste rutene på klippen er helt på høyden med de fineste rutene i distriktet, og de som tilhører den motsatte kategorien er vel verdt å styre unna. Utviklingen har stoppet opp, muligens fordi klippen ligger langt unna de som var sentrale i utviklingen av den, men potensialet er på langt nær utnyttet. Spesielt en del av veggene som ligger lenger opp i hovedformasjonen har en rekke prosjekter på prima fjell. Slåssveggen byr i tillegg til suspekt fjellkvalitet også på regnsikker klatring, noe det ikke finnes mye av i distriktet. Dialogen med grunneier er svært god, og om sommeren selger grunneier som har bondegården sin på andre siden av veien bær fra selvbetjent utsalg. Ikke alle crag har eget bærutsalg! På Mekka får man følelsen av å være på landet, med bondegård og rautende kuer som akkompagnerer klatringen. Veien som passerer rett ved klippen genererer imidlertid en del støy.

Adkomst

Fra Drammen er det to veier som fører til Mekka. Det minst svingete alternativet er å følge skilting mot E18 og Larvik. Ved Sande N, ta av til høyre på vei 313 (etter ca 10km), og følg skilting mot Sande N og deretter Holmestrand. Eller ca 18,5 km fra Drammen, ta til venstre på vei 319 skiltet Svelvik ved bensinstasjon. Fortsett på denne veien til Berger, totalt ca 31,5km fra Drammen. Klippen ligger godt synlig på venstre side av veien. For å parkere, ta av vei til høyre rett før klippen (Bergerveien) og parker ved murhus.

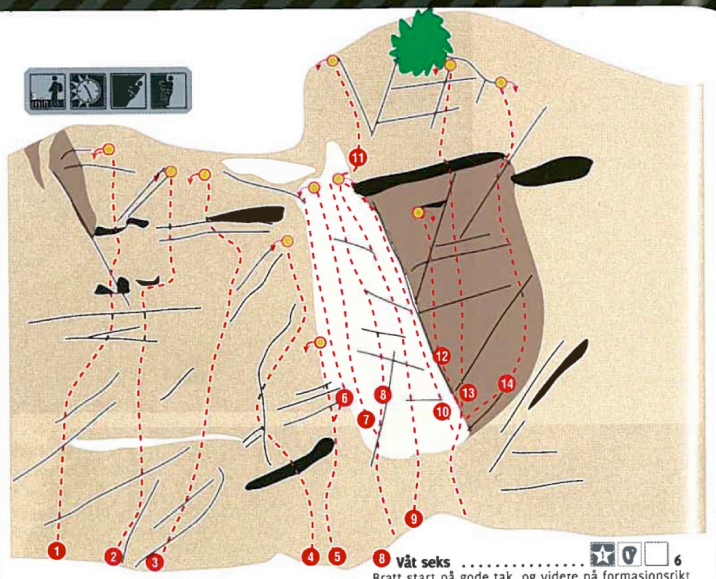
Det andre alternativet innebærer å følge vei 282 (Bjørnstjerne Bjørnsons gate), og ta av til venstre på vei 319 skiltet Svelvik. Kjør forbi Svelvik, og ca 8km etter Svelvik dukker klippen opp på høyre side av veien. For å parkere, ta av til venstre umiddelbart etter klippen (Bergerveien) og parker ved murhus.





Vidar Krøysei på «Blåveisen» (7+), Slåssveggen.

1. Access maps
2. General information
3. Access Information
4. Grade chart
5. Inspirational picture



1 **Ritalin** ..... 7/7+
Buldreinnsteg, deretter lett for så å bli brattere til crux ved utsteg.
Michael R Helgestad 2004.

2 **Mescalin** ..... 7+
Buldreinnsteg, så lett før ihållande klyving til topps.
Tom Atle Bordevik 2004.

3 **Doggystyle** ..... 7+
Buldreinnsteg, så grei klatring til svært teknisk crux. Avslutningen er intet mindre enn fabelaktig.
Michael R Helgestad 2004.

4 **Av og til er to fingre best** ... 7-
Innsteg helt på kanten, så opp til anker under overheng.
Thomas Horgen 2004.

5 **Misjonærmetoden** 6
På kiler opp hjørnet til anker på kanten.
Thomas Horgen 2004.

6 **Prosjekt: Hard seks** ..... ?
Bratt start opp til runding til sva.

7 **Dryppende våt seks** 6
Felles start med Våt seks, siden til venstre opp bratt sva.
Michael R Helgestad 2004.

8 **Våt seks** 6
Bratt start på gode tak, og videre på formasjonsrikt sva.
Michael R Helgestad 2004.

9 **Gruppeseks** 6
Opp dieder til teknisk exit, deretter sva til anker.
Tom Atle Bordevik 2004.

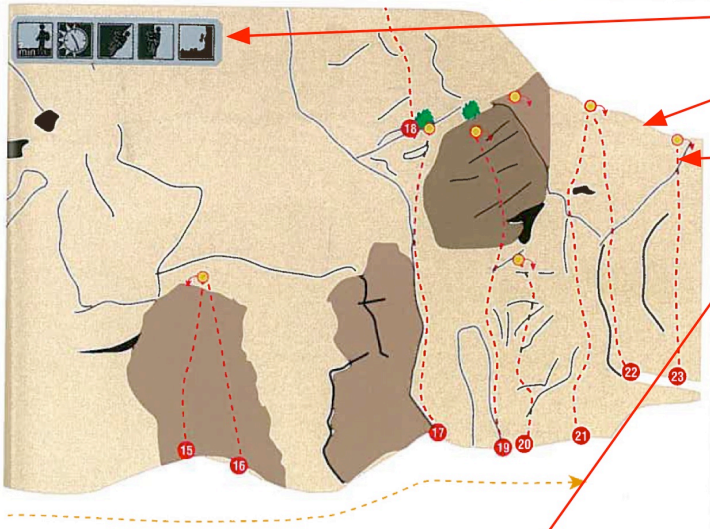
10 **Tørr seks** 6
Innsteg i suspekte formasjoner (bruk evt tau som henger der), deretter grei svaklatring til anker. OBS: ruta er tørr i regnvær.
Marianne & Tom Atle Bordevik 2004.

11 **SEX-tension** 6
Fortsettelsen av alle rutene på svaet opp på vegg over takoverheng i store formasjoner til anker. Luftig og fantastisk klatring. Allerede en klassiker! OBS: 60m tau nødvendig.
Tor-Erik Larsen, Michael R Helgestad og Tom Atle Bordevik 2004.

12 **Prosjekt:** ..... ?
Usikkert om dette lar seg realisere. Borret anker og to bolter.

13 **Drømmepump** 8
Lang og pumpende linje med en god hvil på midten. Gjennom stort takoverheng til anker på 28m.
Michael R Helgestad 2004.

14 **Mitt Mekka** 8
Pumpende, men med gode hviler. 27m.
Tom Atle Bordevik 2004.



Duracellveggen:

15 **Pes** 7
Artige unorske formasjoner til anker over lite takoverheng.
Vidar Kragset & Ulf Albinson 2004.

16 **Operasjon dagsverk** 7-
Oddgeir Malmø & Ulf Albinsson 2004.

17 **Hvis du faller må du ha baller** .. 6+
Lang rute i noe suspekte formasjoner. Tørr i regnvær bortsett fra helt på slutten, men her er det store tak.
Michael R Helgestad 2004.

18 **Sprekken** 6
Andre taulengde av Hvis du faller... Dette er også adkomstrute til Buldreveggen som foreløpig kun har prosjekter.
Michael R. Helgestad 2006

19 **Du skal ikke forvente så mye av fornuften** 8
Lang og bratt. Siste del er svært hard/buldrete.
Michael R Helgestad 2004.

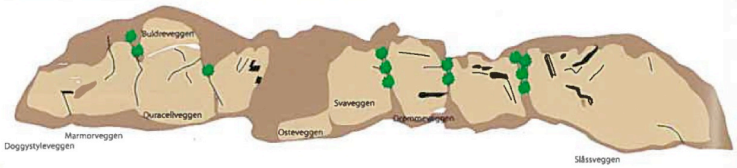
20 **Judas** 8-
Grei klatring til første anker. Etter dette er det et prosjekt (åpent) med et umulig crux, som venter på buldresterke klatrere. Avslutning på gode tak gjennom det bratteste partiet på Duracellveggen.
Ukjent

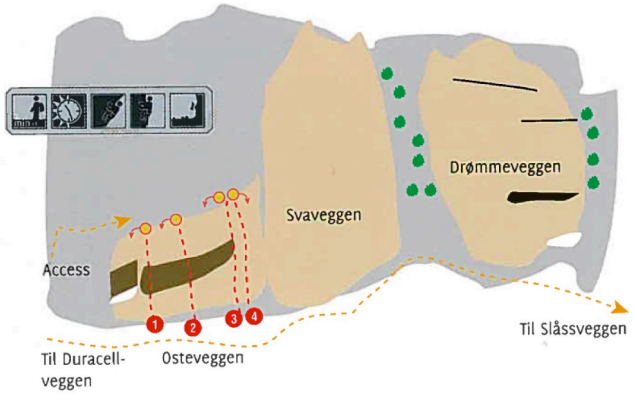
21 **Mr Duracell & Dr Buldrevik** .. 7
Lang og svakt overhengende rute. Fabelaktig avslutning.
Michael R Helgestad & Tom Atle Bordevik 2004.

22 **Mr sure Kjell & Dr Tullevik** 7
Parallell linje som Duracell, til samme anker.
Vidar Kragset & Ulf Albinson 2004.

23 **Båtsmann og jeg** 6
Grei klatring, hardest i starten. Må pusses bedre for at graden skal holde stikk.
Vidar Kragset & Ulf Albinson 2004.

1. Wall
2. Wall characteristics
3. Wall map / Topo
4. Route outline
5. Route Information





Osteveggen:

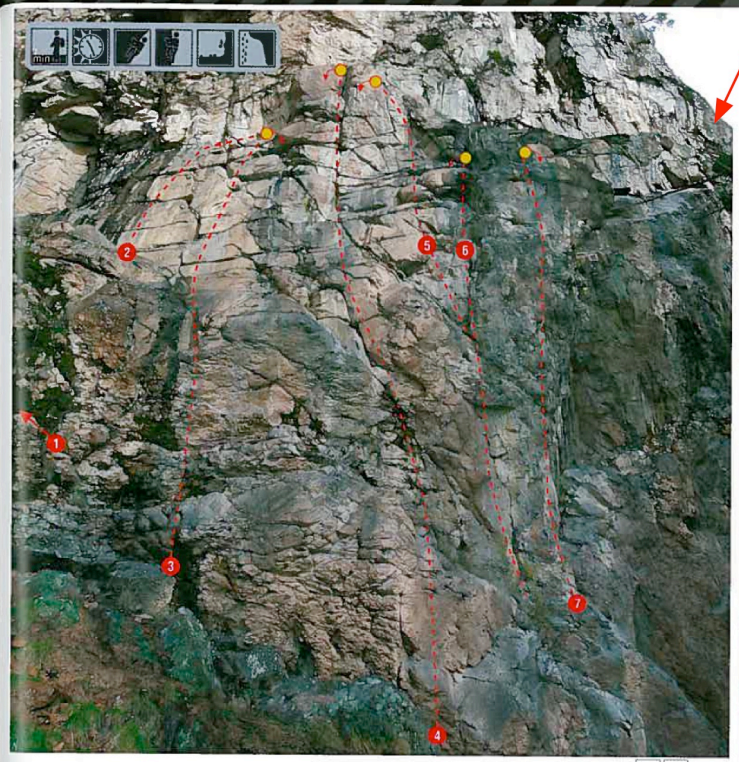
1 **Ost med din glede** ..... 7+
Artige formasjoner, men ikke optimale bolteplasseringer pga suspekt fjell. Crux etter sistebolt.
Marianne & Tom Atle Bordevik 2004.

2 **Prosjekt:** ..... ?
Knallhardt buldrecrux ut takoverheng. Prosjektet er åpent, boltet og høyt på 8-tallet et sted.

3 **Hjallaballa** ..... 6+
Renneformasjon, som byr på artig hullklatring i siste del.
Tor-Erik Larsen.

4 **Helse i hvert høl** ..... 6+
Tor-Erik Larsen 2004.

Mekka er en stor klippe, og i tillegg til rutene og prosjektene som er nevnt her, er det et stort antall prosjekter som ikke er beskrevet. Av plasshensyn har vi valgt å ikke beskrive disse, men kommer tilbake med oppdateringer via www.dkk.no når disse gås.
Generelt kan det sies at det er en rekke prosjekter over Duracellveggen. Drømmeveggen har også en rekke prosjekter, men ennå ingen ruter.



Slåssveggen:

1 **Prosjekt:** ..... ?
Lang sak opp vertikal vegg.

2 **Jordbærrus** 4
Gått som adkomst for borring av de sentrale rutene i Slåssveggen.
Tom Atle Bordevik 2004.

3 **Taxikø** ..... 5+
Grei klatring på flott fjell.
Tore Fonn, Tor-Erik Larsen & Tom Atle Bordevik 2004.

4 **To tette og ei badehette** 7
Grei klatring til avslutningen som krever besluttsomhet.
Tore Fonn, Tor-Erik Larsen & Tom Atle Bordevik 2004.

5 **Ska vi slåss du å æ?** ..... 7/7+
Første tre boltene er felles med Springskalle, men hold til venstre inn i nisje/hylle like etter tredje bolt.
Thomas Horgen 2004.

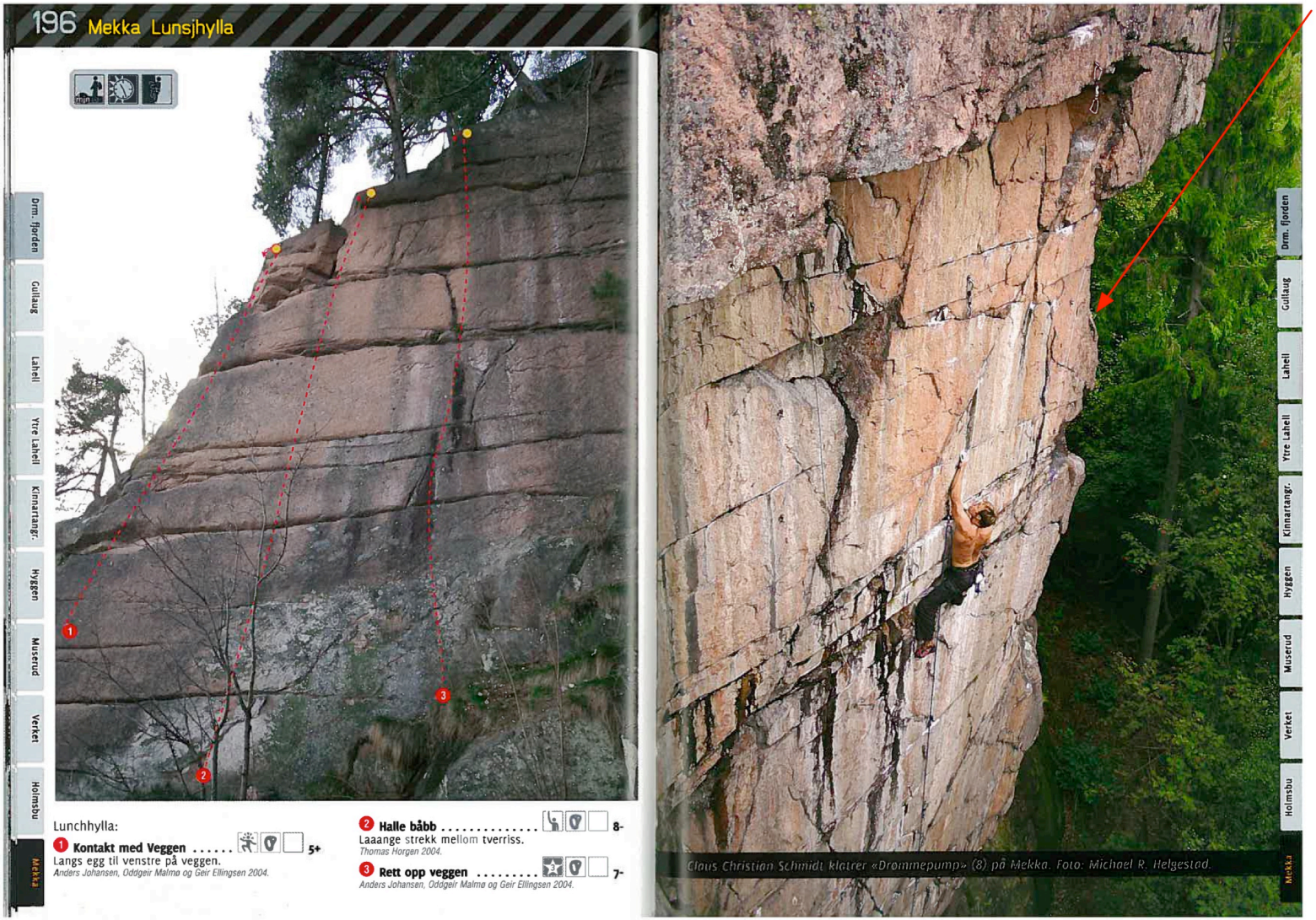
6 **Springskalle** 7
Artig klatring, men noe feilplassert toppanker.
Tore Fonn, Tor-Erik Larsen & Tom Atle Bordevik 2004.

7 **Blåveisen** ..... 7+
Noe mer pumpende enn de to foregående rutene, og et crux som krever besluttsomhet.
Tom Atle Bordevik 2004.

8 **Prosjekt** ..... ?

9 **Mr Andersson** ..... 7+
Buldreinnsteg, deretter bratt klatring på gode tak til en litt mer engasjerende avslutning. Bratt!
Michael R Helgestad 2004.

1. Photographic Wall map / Topo



1. Inspirational picture

2 Designing Crags

This chapter begins with a description of the development phase, detailing choices made and challenges encountered, before moving on to account for the various third party components included in the application and the process of aggregating data. I will then present a general outline of the application, before moving on to more specific features.

2.1 Development

> Any task you're planning to complete will always take longer than expected - even when Hofstadter's law is taken into account
>
> - Hofstadter's law

Development of the Crags application started in October 2008. The application was necessarily developed in Xcode, Apple's software development environment. Applications on the iPhone are developed in the programming language Objective-C. From a time saving perspective, since I did not know Objective-C, I wanted to bypass the process of acquiring the new programming skills, instead using the ones I already had. One alternative was to create the prototype as a web application on the iPhone. This however did not meet my requirements, as web applications on the iPhone do not have the option to access core functionality of the device crucial to this project, such as the camera API and the GPS module. I then found PhoneGap, an open source cross platform framework which allows the construction of applications using high-level web programming languages such as HTML, CSS, PHP and mySQL, while giving access to the device's core functionality through JavaScript. The resulting product combined with Xcode, is a native iPhone application.

When doing practical research on emerging technologies, there are some practical issues worth mentioning as it seems unlikely that they will be exclusive to this case. In the two year span of the prototyping phase of the project, there were extensive changes to the iPhone device, the Xcode application and the PhoneGap framework, all of which affected my work. The first issue became the lack of documentation. If a problem is encountered (and problems occur more often in early versions of devices, applications and frameworks), the scope of the documentation available is much less

than that of established hardware and software. Consequently, the chances of finding solutions through documentation are much lower.

Secondly, because early versions of software and hardware are more often are subject to unstable releases and bugs, much time can be wasted on seemingly trivial matters. While this was not a new discovery for me, my experience was that the added time spent on trivial problem solving in working with *two* early version software components instead of one, was exponential rather than linear. PhoneGap was in a very early stage of development, and Xcode had just begun to support the development of iPhone applications. On Xcode's side, at times I ran into substantial problems with certification and authentication of development profiles and certificates, a process later streamlined and made easier for developers. These problems most often occurred in conjunction with upgrades to either PhoneGap or Xcode. Upgrades to PhoneGap were installed in an attempt to resolve an unstable integration of the GPS, and this would often result in a total breakdown with Xcode. Supporting the various upgrades to the iPhone OS also meant I had to continually follow the upgrades of Xcode, which also posed some of the same compatibility problems with PhoneGap.

Thirdly, there was also the challenge of designing within the limits of what the device was capable of. Practically (not aesthetically), Crags is designed as a web page. More specifically, everything is wrapped within a browser window, which then acts as a native application. Effectively, this means memory limits are subject to Apple's limits for mobile webkit (their browser engine) as well as device memory capability. I began the project developing on the iPhone 3G. Not developing in Objective-C was more demanding on the mobile device, and on the limitations of memory and processor as well as on the limitations of the webkit rendering engine. This set limitations on the graphical user interface. Over the two years of prototyping, the application went from being tested on an iPhone 3G to an iPhone 3GS. The iPhone OS was updated numerous times starting from version 3.0 and ending with 4.1 when development and testing was complete. Upgrades to the phone and the software made it possible to design a more stable user interface and better implement the various features.

For developers of mobile media applications, the rapid pace of development in both hardware and software means that the recommendations that are specified today have a high chance of becoming out of date tomorrow. Nonetheless, I would like to

share some thoughts in regards to any possible further development as well as to those who aspire to develop a mobile application.

As mentioned there are three options for developing applications on the iPhone, a web application, a hybrid application and a native application. Web applications lack the ability to make use of some of device's core functionality, but are a good and cheap alternative if such functionality is not required. Using native applications gives one a little more of that *iPhone feeling* people often refer to, which mostly has to do with smooth animations and responsiveness. Native applications are also more efficient in terms of memory and power consumption, provided proper programming. Furthermore, they are more expensive to develop and are not as easily ported to other mobile platforms[9] as hybrid applications are. With stable releases, good documentation and capable hardware, hybrid application development has now become a valid alternative for developers. Hybrid applications have the advantage of being easily converted from a large display web page and there is also less cost involved to develop for several platforms since much of the code is reusable.

Returning to Crags, there are a few mock-ups with regard to functionality. This mainly concerns commenting and video implementation. As for the remaining work required to turn Crags into a commercial product of high quality, I will sketch out some key issues. As the saying goes, content is king, and the most pressing issue in releasing a high-end commercial product would be to have access to all climbing crags on a national level. This would probably depend on the creation of a database that contains this information, as it does not exist today. The application should ideally be re-written in Objective-C to avoid the current slightly unstable hacks, to handle an upscale in content, for better memory handling and for better battery conservation. Provided some of the hacks can be improved or are now unnecessary in the current release of PhoneGap (or any competing hybrid frameworks[10]), a hybrid solution could also suffice for Crags, considering the aforementioned advantages of hybrid applications. The GUI could benefit from improvements, especially with regards to photo viewing and browsing. Also, another natural step would be to

[9] For instance Android, Symbian, Windows Mobile
[10] E.g. Titanium Mobile: http://www.appcelerator.com/products/titanium-mobile-application-development/

implement and modify functionality based on information gathered from the user test. This is discussed further in the analysis.

Third party helpers

A set of programming libraries, service API's and hacks has been utilized to make Crags work as it currently is. Google Maps Javascript API (Google 2011) has made the map and directions functionality possible. YR.no has an open weather service API used to input weather forecast into the application (Yr 2011). jQuery was used for most of the Javascript functionality, handling user feedback like click events, transitions and movements as well as database communication (jQuery 2011). Richard Walker wrote some excellent PHP-scripts to handle a lot of the queries between the user interface and the database[11]. A Javascript hack named Glovebox was used to enable one finger scrolling within a browser window on the iPhone (GloveBox 2010). Some graphics and CSS from iUI (iUI 2009) was used in the production of user interface elements. Finally, some Javascripts (Veness 2010) were used to help with geospatial calculations.

Data input

Crags is a climbing application that contains data about climbing routes, therefore data about crags, walls and routes is required for user testing. From a basic UML model, I created a MYSQL database needed to contain and deliver the data, and then, since there was a substantial amount of data to be entered, I built a graphical user interface used to input data (Staff 2008). Permission was given from Kolsås Klatreklubb to use the textual information from their climbing guide[12], and the web site Headwall.com[13] gave permission for me to use the wall maps from their site. The result was nine different climbing crags, ten wall maps and 170 routes, each route containing a set of information about itself. In addition to the already existing data I had to produce some myself. About 40 images were captured and connected to their respective routes, and the GPS coordinates of seven different walls were logged and stored. Finally, I captured footage of a climber in action to have some video data for the user test.

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[11] The scripts are available at http://mikkelstaff.net/cps/app/php-scripts/
[12] No written permission has been obtained, but oral permission was given by Jacob Normann, member of the board at Kolsås Klatreklubb.
[13] Oral permission was obtained from Torkel Røysli, developer of headwall.com during a phone conversation

2.2 General outline of the application

This chapter describes the layout and functionality of the application[14]. On application load, the climber is presented with a map view (fig.9). The application will automatically try and locate and centre the map on the climber's position. The map contains markers showing the position of crags with a separate marker for the user position. Accessing settings, the map can be customised to present various map types like road map, terrain map and satellite map. The map can also be zoomed by using two fingers to pinch, or panned by using one finger to drag the map. As an alternate to the map view, the climber can touch the list button on the bottom of the screen to switch over to a list view of crags (fig.10). The crags are listed alphabetically and also detail the number of walls and routes for each crag. Each crag is accessed by tapping the green icon in list view. In map view the crags are accessed by first tapping the crag marker and then by tapping the resulting crag name bar which slides into view (fig.11).

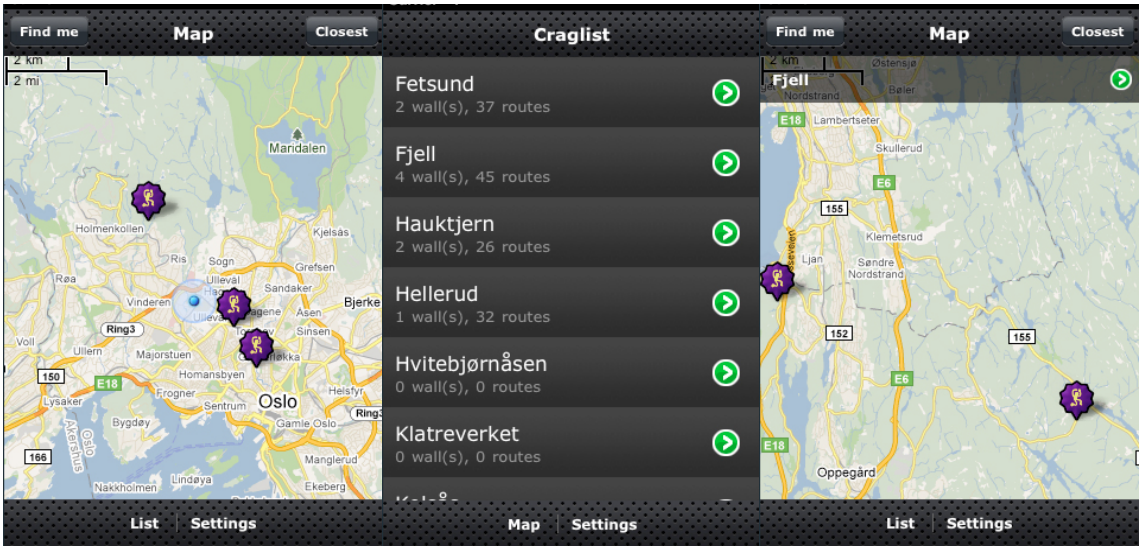

fig. 9: Map view, fig. 10: List view, fig. 11: map view with crag marker activated

The crag panel has seven main buttons plus two in the top bar (fig.12). One of the top bar buttons is a back button, taking the user back to either map view or list view. The second top bar button named *locate* takes the user back to the map view and centres the crag on the map. The first of the seven main buttons, called *driving directions*, assists the climber in making his or her way to the crag; further detail is given in

[14] The application is available at http://mikkelstaff.net/cps/app/, be aware that functionality relying on location-based services may not work.

fig. 12: Crag overview panel, fig. 13: Approach info, fig. 14: History, geology and more panel

chapter 2.3.4. The second button *approach description* gives further access details to assist in finding the way from the car to the crag (fig.13). The third button *history, geology and more* provides historical background for the crag, geological conditions and other useful information (fig.14). The next three buttons provide various ways of accessing wall maps and routes. First, the *walls* button presents a list of all the walls as buttons (fig.15). On selecting one of these walls, the climber is presented with a list of topos for that wall, displayed as small images of the wall map (fig.16). Again, when selecting a topo by tapping, the topo is presented in full size[15]. The header presented on initiation (fig.17) fades away after five seconds. The header contains two buttons, a back button and a list button, the latter presenting a list of routes for that particular

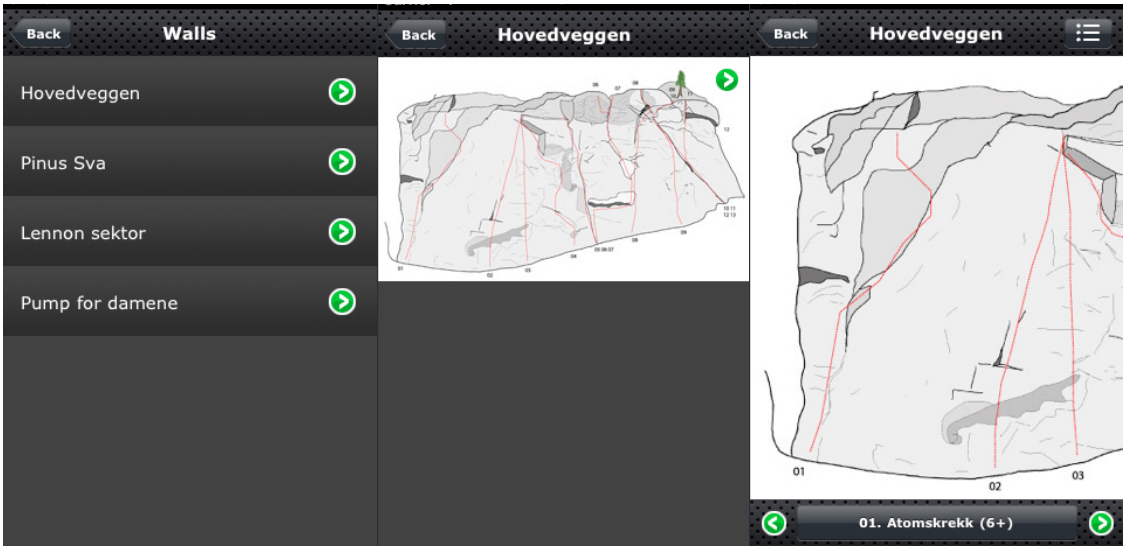

fig. 15: Walls panel, fig. 16: Wall map list panel, fig. 17: Wall map panel

[15] Full size means that the image has a fixed height of 420px

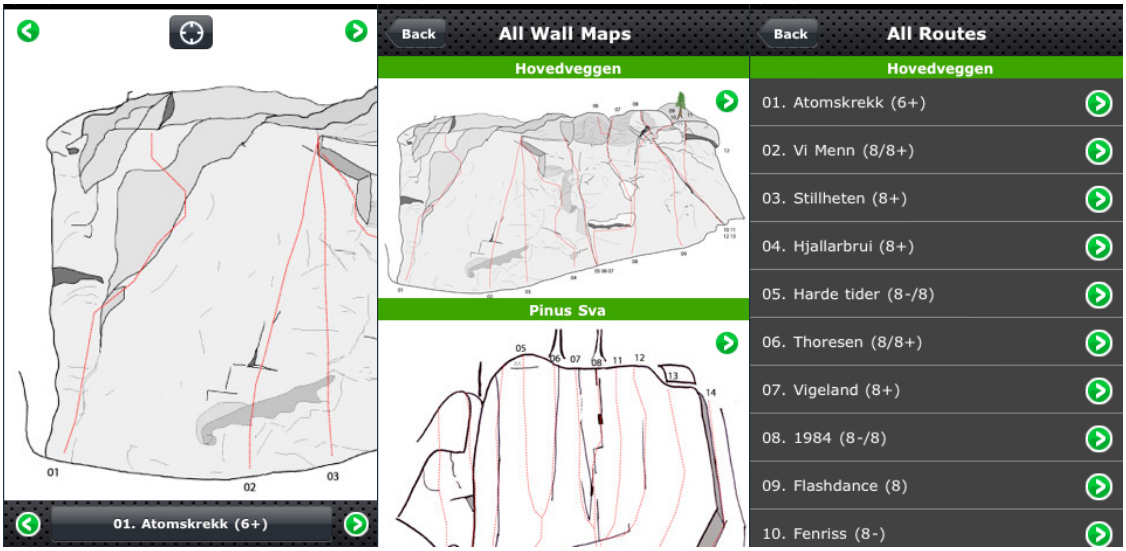

fig. 18: Wall map panel without header, fig. 19: All wall maps panel, fig. 20: All routes panel

topo. The header can at any time be faded back into view, by a single tap on the topo. After the header fades out, two green buttons are visible in each top corner of the screen (fig.18). These are used to pan the map left and right as the arrows on the button indicate[16]. In between these two buttons is a black button that activates the GPS Locator (further described in chapter 2.3.3). Finally, at the two bottom corners of the display are two green buttons that enables the climber to scroll through the routes for that topo. The routes are then themselves displayed as buttons in between the green buttons.

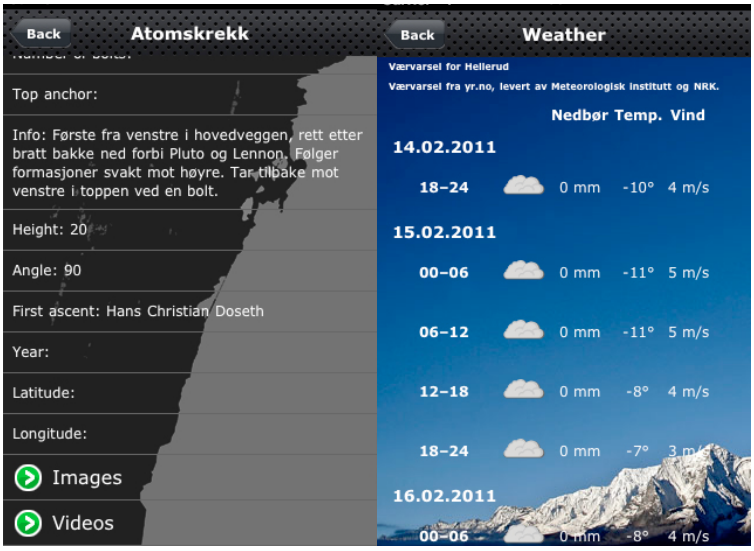

fig. 21: Route info panel, fig. 22: Weather forecast panel

An alternative way to access the topo is also presented. The climber can tap the *Wall Maps* button and a list of all crag topos is shown (fig.19). One touch further and the climber is presented with the topo view as previously described. Upon tapping the *Routes* button, all routes of the crag are displayed in a list (fig.20). Each item in the list has a button that triggers display of

[16] Using one finger to pan the wall map as in the map view panel was the original intention, however due to technical difficulties this feature had to be abandoned

the route info panel (fig.21), which contains useful and important information about each route. The last of the seven buttons in the crag panel is the weather forecast button, which slides the weather forecast panel into view, displaying weather forecasts for a five day period (fig.22).

2.3 Specific Implementations

With the general layout and structure of the application described, I will now move into further detail on implementations relating to the properties of inquiry. Firstly, the database as a prerequisite for a hypertext is discussed, before moving on in the next chapter to discuss the realisation of the hypertext through the design of the user interface. Then location-based services implementations are detailed, ending with a description of the implementation of images and video.

2.3.1 The Database

In the humanities, scientific endeavours on emerging technology are firmly rooted in theory. In these cases, theory provides both foundation and perspective to the readers. As Landow points out, critical theory used on new media phenomena can also play a role "similar to that of the graphite particles and ultraviolet light that make previously invisible fingerprints and other unexpected traces suddenly appear. Innovation creates new aspects of ourselves and theory reveals them."(Landow 2004, p.35). When working from a practical/theoretical perspective, there is also the practical point of view, revealing challenges and limitations that need to be considered. I am therefore not solely focused on what is theoretically possible, which would imply that practical limitations would sooner or later iron themselves out on the fabric of innovation. The use of mock-ups and other 'fake' implementations are an essential part of prototyping. However, in order to produce a high-end working prototype I must at least partially consider the limitations of design in a practical sense. As this chapter shows, the technical matter of database implementation has consequences beyond the purely technical, as it also affects the interface design and the user experience.

A database is not the same as a hypertext, though in this project they are tightly coupled. Hypertexts are most accurately described by a link/node structure[17], whereas databases are often structured as tables. Once the data from a table cell has been extracted, used in the graphical user interface (GUI) and is connected by links defined within that GUI, a hypertextual structure emerges. The table cells then act as nodes, with graphical interaction elements acting as links. How the database is implemented in the application is not purely a technical matter, it affects the user experience and the design of the GUI. Making a design unobtrusive to allow for varying levels of accessibility of Internet services[18] is subject to different trade-offs, which affects the design. Three different options are presented.

Remote database

There are some obvious advantages to having a remote database provide data to the application. Seeing that conditions change (added content, changing status of existing content), a cloud database will always be up to date whenever accessed. Moreover, a centralized database has virtually no size limit. This means the database can potentially contain crags from all over the world. For the user, this implies that Crags can be used wherever s/he travels. One premise for this scenario is that a global database of climbing routes actually exists, which to this day it does not. Also, seemingly minor aspects like cost of data roaming (which tends to be rather expensive) could have a severe impact on a climber's behaviour when interacting with the application and should thus be taken into account. Furthermore, most networked computer systems assume continuous network connectivity. This is not the case in a mobile environment relying on wireless network connections, and it is therefore desirable "for mobile guides to function (to some degree) even if there is no connection or if information is partially unavailable"(Baus, Cheverest et al. 2005, p.195). Relying totally on network connectivity renders Crags unable to degrade gracefully when users are moving outside areas of network coverage.

Local database

Conversely to a remote database, a de-centralized database is not subject to the changing network conditions, ensuring data acquisition (except GPS position) at all

[17] For more on hypertext structures, see chapter 3.2
[18] The homogenous network conditions for different usage situations are also discussed in chapter 3.5

times to increase the functional stability of the application in various physical contexts. It will also most certainly reduce the load time of data into the application, and making it quicker will be positive for the user experience.

There are of course disadvantages. A local database containing text, images and video will take up disk space, which at some point will limit the possible size of the database. Video footage especially is demanding on disk space. Consequently, a limited database size will probably mean that the number of crags in the application will be limited to an enclosed geographical area. If users are to be able to contribute with comments, images and videos to Crags, this will need to be synchronized across a network so that data gets updated, making the application subject to rapid updates or only partially local.

Local / Remote database

To be able to let Crags degrade gracefully and at the same time exploit the advantages of having a centralized database, the third option is to have the application make use of a local and a remote database. For instance, in order to be able to access a crag regardless of network connection, users could before leaving for the crag, download the crag in question from a remote database to a local database at home or another place where network coverage is ensured. Some of the challenges here are the relations between the two databases. Good interface design should be able to let the users clearly identify the state of the crag. Is it remote or local? Is the local data old or up to date? Considering the time it will take to download a crag, should the local database also contain larger data objects like videos and pictures? Designing for a remote/local database setup requires implementing good user feedback on the state of the data so as not to confuse the user as well as implementing functional update mechanisms. The purpose here is not to establish which solution is the right one for Crags. Client-server network technology is a rapidly evolving and complex field of informatics, and designs that are good for today can be a limitation in the short future. The purpose rather, is to describe how often conflicting technical possibilities and challenges have widespread consequences, onto which design choices have to be made in the process of development.

2.3.2 Navigating a Crag

The climbing guide is composed of various information elements, which can be ordered into a hierarchy with blocks of information divided and subdivided. Because of the way information can easily be divided into separate blocks of information, adapting the text into a hypertext system was not a complicated issue in regards to selecting the nodes and the boundaries of their content.

The climbing guidebook often contains a double index overview of the crags placed in the first pages of the guide. One index is the map with the crags marked on it; the other is an index list. In Crags, this has been reproduced by showing the map view as the first screen when the application launches. The map has markers for each crag and contains all crags in the database. By the tap of a button at the bottom of the screen a list of all crags is shown, analogous to the index list in the book.

Rather than arranging information in an arbitrary fashion, emphasis has been put on structuring information so the reader can navigate the climbing guide with a minimal cognitive effort. There are many differences between the user interface of the book and of the iPhone, among the most obvious are the discrepancies in physical size. I therefore sought a design that accommodates both the structure of the climbing guidebook as well as a natural[19] way of interacting with a small screen on a mobile device. Perhaps the most obvious way of designing a user interface that seems familiar to the user is by drawing on the user's previous experience, i.e. conventions of design. This is why a design based on the navigational structure of an iPod (and most other mp3 players) was found suitable for Crags. The hierarchical structure of a crag is similar to the discography of The Beatles in the sense that there is a mostly consistent structure with a one-to-many relationship. Similar to how The Beatles have many albums, which again have many songs, so to can a crag have multiple walls, which in turn can have multiple routes. A full visualisation of the navigation structure in Crags is available in appendix 2.

[19] *Natural* being a fuzzy term, is here meant as something familiar or something being displayed in such a manner that there is a minimal learning curve in order to understand how to navigate the hypertext.

Animations

The screenshots above should suffice as an introduction to the user interface of Crags, however what is not presented is the use of animation effects. Animations arguably have their own rhetoric, and by meticulous implementation animations can function as valuable information carriers. In Crags I have used a number of different animations, among them fade-in/out effects used on loading screens, slide-up/down effects used to display information in various places, flip effects and left/right sliding panels. I would like to highlight the importance and the communicating power that lies in the proper use of animations with a brief referral to the two latter effects.

The transition from the list view to the map view is animated with a flip effect. This is a metaphor for a coin or an album cover, communicating to the user that s/he is viewing two different representations of the same information[20]. When the climber is navigating a crag, browsing the wall, topo and route panels is represented with a sliding panel effect similar to the iPod and other mp3 players. The intentional effect is mainly to make use of this convention when browsing hierarchical information on a small display. In addition to the advantage of familiarity, the sliding panel effect also communicates visual continuity. As a panel slides out to the left when one slides in from the right, a connection between the two panels is made, reinforced by a reverse animation as the user navigates backwards. As the panels uniformly slide left or right depending on the direction of navigation within a crag, the trail of navigation is reassured and metaphorically expanded beyond the physical limits of the device display (fig. 23).

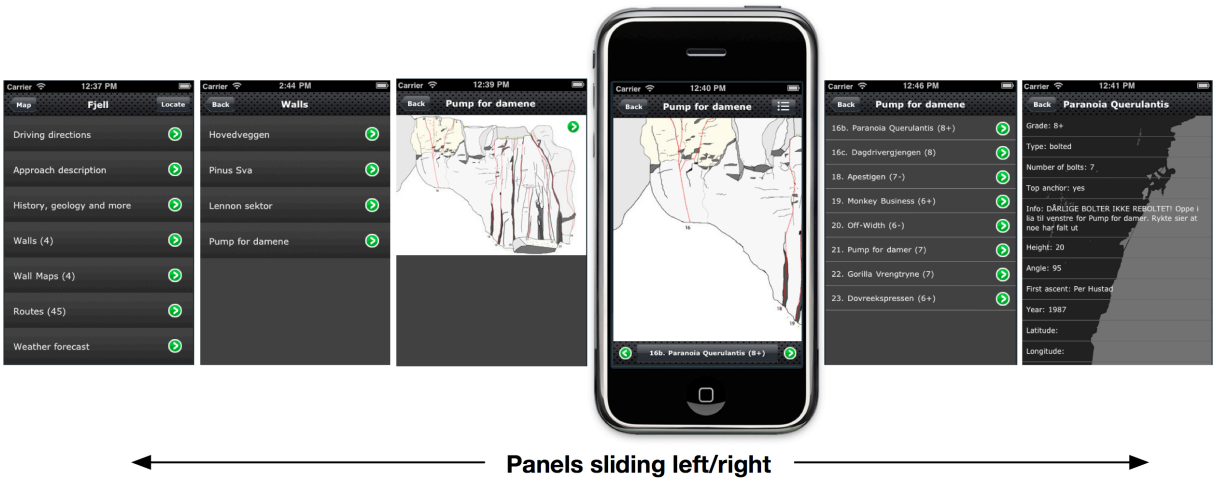

fig. 23: Sliding panels

[20] Actually it is just two different presentations of the same content, table cells or nodes fetched from the database.

2.3.3 **GPS Locator**

fig. 24: Illustration on wall map placement in physical environment

At the crag, there is often a need to orientate yourself to your surroundings. This is done with the goal of finding the desired route. When using the climbing guide for this purpose, the topos are the most common tool for orientation. These illustrations convey information about the locations of routes, sometimes with route names and grades embedded. The illustration also shows recognizable wall features like overhangs, cracks and/or trees, which are used as points of references. The GPS Locator uses location-based services (LBS) – when available – to help with orientation to the surroundings. This is done by a virtual fixing of the topo to be positioned vertically upright on the earth's surface (fig. 24). Figure 25 shows how this is implemented. The beginning and end of the topo are each given geographical coordinates (A and B). The topo's bearing, the straight line between A and B, is then calculated. The climber is then assumed to be looking at the wall from at a 90 degree angle. To find where the user is looking at the wall, the user's position with a bearing that is 90 degrees to the topos' bearing, is calculated. The intersection of these two bearings is the user's position. To display this on the mobile device, the relative distance between the intersection point and the start and end coordinates of the map is then used to place a marker on the topo. The marker is positioned at the same relative distance between the left and right edges of the topo image. Figure 26 shows the implementation of this feature in Crags. First, the user is presented with a topo that is scrollable in a horizontal direction. By tapping the icon with the crosshair image at the top of the screen, the GPS module is activated; the icon

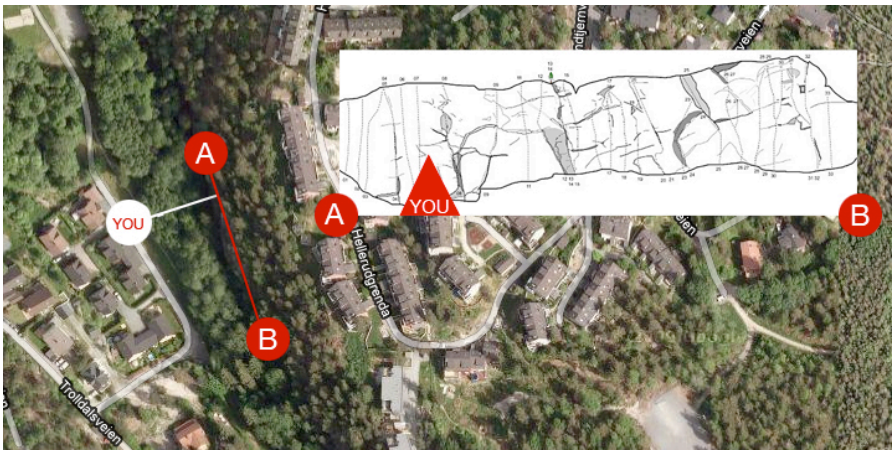

fig. 25: Vertically overlaying wall maps on geographical features

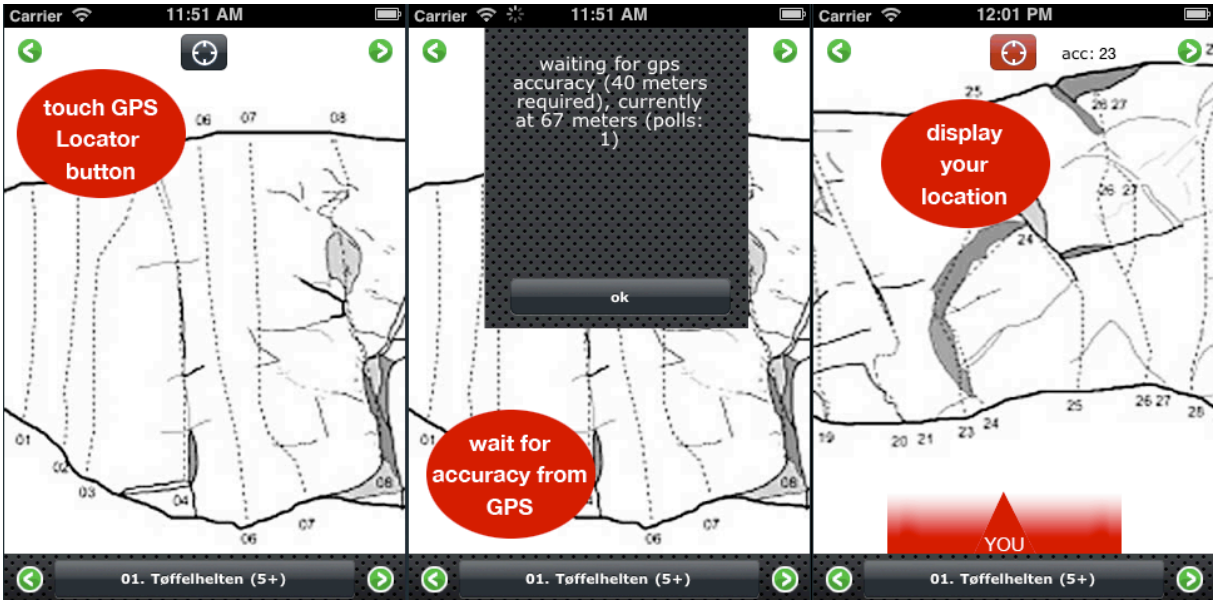

fig. 26: Implementation of GPS Locator feature

shifts to a red background colour to indicate that the GPS Locator is active, accuracy is displayed next to the icon and two markers are presented at the bottom of the display, respectively indicating your position and the error margin of your location. If the GPS module fails to meet the required accuracy instantaneously, the user is informed of polling status and accuracy with the use of a status panel. The status panel slides back out of the screen when the required accuracy is met or when the user taps the *ok* button on the panel.

This feature is designed to be un-obtrusive with regards to the climber's ability to browse the crag when there is no LBS available. The user is still able to browse through walls, wall maps and routes as s/he would in a book.

2.3.4 Getting Driving Directions

In its book form, each crag of the climbing guide usually has a map showing route directions to the crag. This is often combined with text that details road access, parking and a description on how to get to the crag from the parking lot. This has been adapted to Crags in two ways. First, under each crag, an info button slides in a panel that contains written information on road access, parking and walking directions from parking as well as illustrations that show road access. Second, access information has been enhanced by utilising LBS. By making use of the Google Maps API and its directions functionality, a dynamic driving directions feature is made

available. The feature is activated by tapping the *Driving directions* button in the crag overview panel (see fig. 12). The route suggested is automatically fit into the display by resizing the map's zoom level, and then the suggested route is shown by drawing a semi-transparent blue line on the map between point A (your position) and point B (your destination), as shown in figure 27. One advantage of using this dynamic map solution as compared with the maps used in guidebooks is that the route suggestion is personalised by taking the user's whereabouts into account. This means you will get the right directions no matter where you are coming from. Also, if you happen to make a wrong turn or deviate from the route suggested by some other means, you have the option to ask for directions again, thereby generating a new route suggestion. Pressing the info button on the top right corner of this panel will slide in yet another panel containing step-by-step instructions for the route suggested (figure 28). When compared to the guidebook, textual driving directions function as complementary information to the Google map service in the same way as written driving directions supplement the printed map.

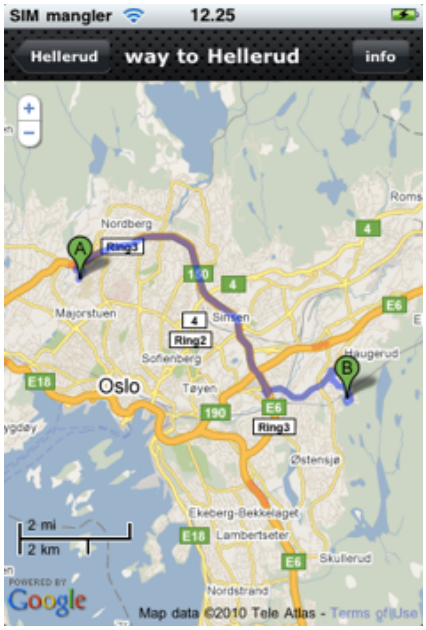

fig. 27: Route suggestion by map

fig. 28: Detailed driving directions

2.3.5 **Find Me, Closest, Locate**

Three other LBS functions have been implemented in Crags. By default, Crags tracks and updates the user's location when the map view is initialised, but as the user explores the map by panning with one finger, his or her location on the map quickly disappears out of view. By tapping *find me*, the user is immediately brought back to the centre of the map. Secondly, the *closest* function – meant for situations where the climber wants to explore the surrounding area – calculates which crag is closest in proximity to the user and centres that crag on the map. Finally, the last LBS feature is

to be found in the crag overview panel (fig. 12). By tapping the button named *locate* on the top right coner, the climber is directed back to the crag map view, and the map is then centred on the crag in question.

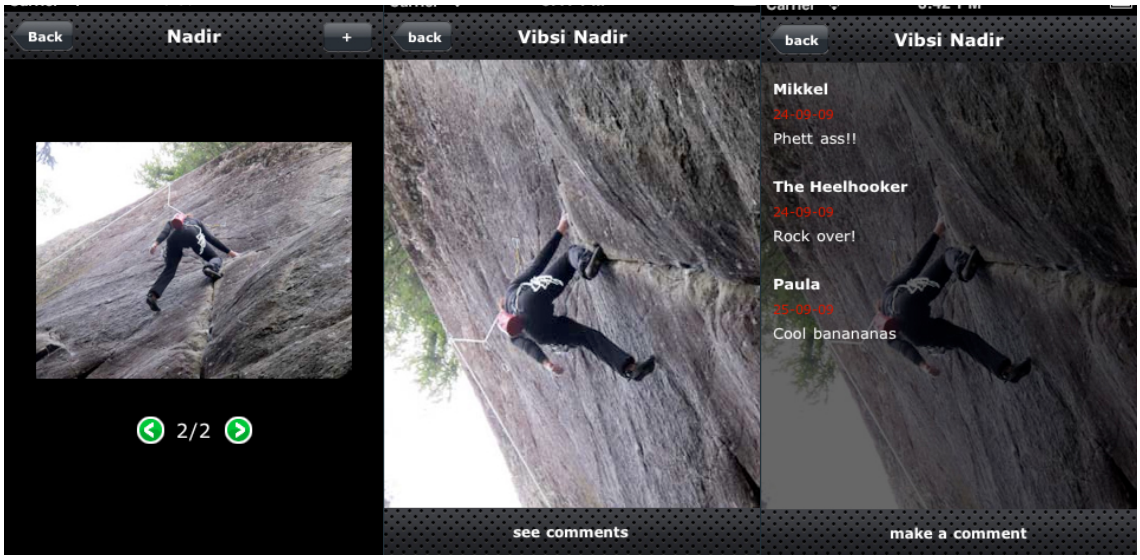

fig. 29: Route images panel, fig. 30: Route image panel, fig. 31: Comments panel

2.3.6 **Images and camera**

One of the two most notable unique modalities of Crags as compared to climbing guidebooks is the implementation of images. It is not entirely unique, photographic images certainly occur in climbing guidebooks as well. However, in Crags there is potential for having a lot more photos and more uniquely, the climber can contribute with personal photographs. In climbing guidebooks the use of images is usually limited to one image per crag. In contrast, Crags' photo implementation makes possible a potentially unlimited number of images connected to a route. The route info panel (fig. 21) contains a button that activates the *route images panel* (fig. 29). The images are in a list that can be browsed through by tapping the green buttons. A tap on an image displays it in full size (fig. 30). From the route image panel it is possible to bring up the comments panel (fig. 31) by tapping *see comments* at the bottom of the display. A further option to write your own comment is available by tapping the *make a comment* button in the comments panel.

In the route images panel (fig. 29), there is a button on the top right corner. When tapped, a semi-transparent panel with two buttons slides up (fig. 32). The user can choose either of these two buttons to add an image to the route; one button activates the iPhone photo library, the other initialises the iPhone camera to make a new snapshot[21]. The image is then uploaded directly to a remote server.

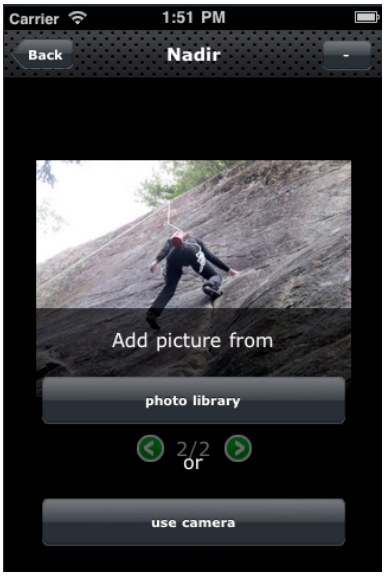

fig.: 32 Add image

2.3.7 **Video**

For texts written as traditional books, the use of live images is still impossible. An exception is to be found in the phenomenon of the kineograph (Wikipedia 2011a). Popularly called flip books, the kineograph is spatially demanding and heavily reliant on the readers active manipulation in order to produce a moving image effect. In Crags, the climber can view videos of a route by clicking on a button in the route info panel (fig. 13). When tapped, the *videos* button brings up a list of videos, that are themselves accessible by tapping a play icon next to the name of the video (fig. 33). There is also a comment link to each video with similar layout and functionality as described in the images commenting feature. The videos feature was implemented as a mock-up[22], mainly because of the time consuming nature of capturing video recordings of climbers ascending all the routes of a crag.

fig. 33: Video panel

[21] The photo library and camera acts as an integrated part of the application.
[22] Mock-up in this case implies that the same three videos were viewable on each route. And since I was unsure on bandwidth conditions for the user test, the videos were embedded into the application in order to bypass the issue of streaming the videos.

3 Theoretical perspectives

This chapter serves as a theoretical backdrop for the thesis. Initially hypertext, multimodality and location-based services – the three properties in focus – are presented. Hypertext theory is used to highlight the peculiarities of hypertext in a comparative perspective against linear texts. Likewise, the theory of remediation provides historical context to the concept of multimodality. Remediation also gives valuable insight to the rhetoric of adaptation as well as giving a perspective on the strategy used for adapting Crags to the iPhone. The use of location-based services and its applications are given a historical and contemporary context. Lastly, activity theory from the field of human-computer interaction is employed for contexts of use considerations as well as to connect the other theoretical backdrops to practical design.

As a natural point of departure, I will outline the tradition of linearity from which the book stems before describing hypertext in more detail. Although the object of my thesis a work of non-fiction, by contrasting examples of fiction in different media I will outline a perspective for assessing whether a hypertextual restructuring is beneficial. From this perspective, a further assessment of the hypertextual potential is based on a possible alignment between metaphorical conceptualisations of hypertexts as landscapes and Crags' relation to physical landscapes. Conclusively, the chapter on hypertext will briefly outline the hypertextual characteristics of Crags.

3.1 Traditions of linearity

The transformation of a climbing guide from a book to a smart phone like the iPhone involves adapting content from a medium whose structure and logic are based on a concept of linearity to a medium readily supporting hypertextual structure and logic. The classical novel is a linear text, read from beginning to end. This linearity is reflected in the physical embodiment of the text in the book. We start at the first page and read it in a linear fashion, ending with the last page of the book. There is a strong coherence with regards to linearity between how we read the contents of the medium and how we interact with the medium itself. This coherence between medium and content is neither resting on any law of physics, nor does it rest any other unbreakable law within the realm of science. We could for instance envision reading

the odd pages of a book first and then the even pages, with the content printed accordingly. But this seems strange and unnatural to us. It is just as conventions and habits have given us a hard time imagining other sensible ways of reading a book. The point is that the strong connection between linearity and medium is dictated by convention, not the physical characteristics of the medium.

The appropriation of linearity to the medium can be said to have influenced other types of books less concerned with linearity than the novel. In lexical books for instance, the placement of the table of contents seems to confirm the expectancy that one will start at the beginning of the book. The dictionary is arranged in an alphabetical (linear) fashion, even though few people read a dictionary back to back. Even cookbooks seem to embrace the concept of linearity. They begin with entry dishes and finish with desserts, reflecting the progress of a three-course meal as well as the linearity of the book.

Linearity in narratives, which seems so natural to us, is like hypertext a human invention. On perception, the Greek invention of *linear logic* has made us develop "specific coding criteria enabling us to perceive, define, conceptualize, and understand specific portions of reality"(Cicconi 2000), and subsequently, the fictional narratives of our reality or realities. This linear logic is so permeating it becomes invisible in our perception of the world and in the narrative worlds we read and write (Cicconi 2000, p.14).

Claude Lévi-Strauss argued for a deeper, underlying meaning to myths and their narratives in his studies. From the perspective of social anthropology and structuralism, Lévi-Strauss claimed all myths had a similar structure, and that the myths as meaning carriers on a deeper level functioned as a way to make the world explicable, "[…] in order to banish contradictions and make the world understandable and therefore habitable; they attempt to put us at peace with ourselves and our existence"(Storey 2006, p.90). This does not imply that people always watch a movie in order to make their world more habitable and understandable; like there are many forms of narratives – plays, movies, novels and so on – so it is many these narratives are read, watched or heard. One could watch a movie because of boredom, excitement, as a social event and so on, but these reasons do not necessarily contradict with their function according to Lévi-Strauss. Many popular forms of narratives seem to embrace concepts like explanation and closure.

In this way, they are supporting the Lévi-Straussian argument. By example the classical Hollywood cinema – arguably the most influential movie production centre in history – is subjugated to a wealth of conventions, where many of these contribute to a closed and linear narrative where there are no loose ends, the narrative plot is consistent and fully explained (Bordwell and Thompson 1997, p.108).

3.2 Hypertext

Hypertext[23], coined by Theodore H. Nelson close to half a century ago (Nelson 1965), describes the networking of texts, often described as nodes, connected by links. The hypertext then is defined as the body of nodes and links. The prefix *hyper* stems from Greek. The etymological meaning *over* or *beyond* (Oxford English Dictionary 2011a), illustrates the hypertext's character in contrast to classical linear texts. It is the networking of texts and the relationships between these texts, as well as how this affects the ways we read and write hypertexts that makes an essential difference.

Conceptually, hypertextual structure is not dependant on the digital medium. Joyce's *Ulysses* (1922) is an often referred to novel predating the digital era which employs a hypertextual structure. Another example is Vladimir Nabokov's *Pale Fire* (1962). Within pop culture the series of *Choose Your Own Adventure* is yet another testament to the pre digital hypertexts. As Bolter reminds us, writing is spatial and hypertextual elements are to be found in the indexes and table of contents of books (Bolter 1991). Nonetheless, hypertext is generally regarded as a child of the digital era[24], and most theorists refer to Vannevar Bush's article *As We May Think* (Bush 1945) and its description of the mechanical machine Memex as a starting point for hypertext. The most obvious and widespread use of hypertexts today is to be found on the World Wide Web as an integral part of the plethora of blogs, newspaper articles, online encyclopaedias, forums and so on. In fact, the permeating effect of World Wide Web in society has made the use of hypertext so natural and apparent that it might seem trivial. However, just because novelty has been replaced by everyday use, it does not mean it is of little relevance to employ a hypertextual perspective.

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23 Hypermedia is a related term that differs from hypertext in its multimodal aesthetic. I will use the term hypertext, also in descriptions of hypermediated texts

24 Already 20 years back, hypertext was a term referring "almost exclusively to computerised hypertext programs, and to the textual structures that can be composed with their aid" (Delany and Landow 1991, p.4)

The juxtaposition of books and digital hypertexts are subject to a wealth of scientific enquiries. With the early aggregation of hypertexts over 25 years ago, scientists were able to identify key differences still relevant today. A practical and useful example of such an enquiry is *Reading and Writing the Electronic Book*[25] (Yankelovich, Meyrowitz et al. 1991). Although useful for insight through practical differences, a broader description might give a deeper insight on the peculiarities of books and digital hypertexts. In adapting a text from a book to a mobile device, from a medium with its inherently linear structure to a medium supporting hypertextual structure, a good question to ask oneself would be: Does the adaptation benefit from a restructuring? If so, how can I conceptualise and understand these structures to the benefit of my adaptation? With the tradition of linearity already detailed, hypertext theory is needed to shed light on this question.

3.2.1 Function over form

The implications of the shifting relationship between author and reader in hypertexts have been well mentioned (see for instance Delany and Landow 1991, p.29; Slatin 1991, p.158). As the reader of a hypertext moves through the text by his or her own choices, he or she becomes a co-author in that specific reading of the text. In the hypertext narrative the reader is no longer just the recipient of the narratives, being told how to make sense of the world. The reader of a hypertext narrative is instead confronted with choices and dilemmas in his co-authoring. Instead of being told how the world *is,* the narrative asks the reader how the world is. The burden of explanation is shifted from medium to reader. If the deeper meaning of narratives – in their many present forms as novels, plays, movies and other narratives – is about explaining the world to us, the hypertext arguably creates a tension between telling and being told, between explaining and being explained to.

This tension can serve to partly explain why some forms of hypertext narratives are more successful than others. For instance, even with the coming of the digital age, hypertext novels have yet to topple the regime of the classic linear novel. As the *Choose Your Own Adventure* series shows[26], successful occurrences of hypertext

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[25] A comparison titled *"print medium: advantages and disadvantages"*(Yankelovich, Meyrowitz et al. 1991, p.54) gives a structured overview of hypertext vs. book (see also appendix 4)
26 Selling 250 million copies and listed as 7th best selling series (ref. e-mail correspondence with publisher)

novels are to be found. However, if contrasted to the amount of classic novels with a linear narrative, hypertext novels are still the odd one out. Conversely, computer games have become a huge industry[27], and many computer games utilise both hypertextual structure and narratives.

Before I proceed, let me first make a few clarifications. There has been a rather fierce academic dispute between ludologists and narrativists regarding the applicability of narrative theory on computer games (Simons 2007). Espen Aarseth goes as far as to question whether games can be regarded as (media) texts at all (Aarseth 2004, p.47) while others maintain that narrative theory can produce valuable contributions to game studies (Jenkins 2004). Without delving further into this dispute, my argument is if we acknowledge the existence of narratives in computer games[28], we should also be able to say something about the narrative structures in these games.

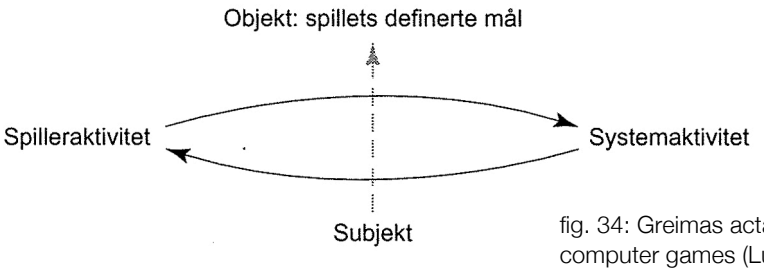

fig. 34: Greimas actant model derived and used on computer games (Lundby and Kristiansen 2003, p.189)

Games have a different function than the classic linear novel. If the novel is about the desire for being told a story, many games are – aligned with the trait of co-authoring in hypertexts –more about playing a decisive part in the unfolding of the story. In a derivation of Greimas mythic actant model used on computer games (fig. 34), the dynamics of play occur along the narrative or project axis (y-axis), and the gameplay or conflict axis (x-axis). The term gameplay is a central and somewhat complex term used on computer games. Much employed to describe or measure the quality of the game, gameplay relates to the balance between player activity and system activity.

> "When the significance of the project axis is reduced, the axis of conflict comes into dominance. [...] A project that continually evolves and progress remains, but the purpose is no longer primarily to reach the end, to close the book, but to stay in the ever-changing process of play, of gameplay"(Liestøl 2004, p.403).

[27] Total spend on games in the US estimated to around 15.5bn USD in 2010 (NDP Group 2011), in comparison (and not to be confused with the total turnover of the movie industry) American box office spending 2010 amounted to around 10.5 bn USD (Box Office Mojo 2011)
[28] This is not a point of controversy, it seems to be agreed that narratives are evident in some games. However their quality and prominence are another case (Aarseth 2004, p.51)

The popular computer game genre of role-playing games makes it obvious how the experience of playing is about more than the unfolding story line; it is also about the desire for immersion and exploration of the story universe. The hypertext structure can support the realisation of those desires by allowing for freedom of exploration within the linear narrative (fig.35). When exploration of the game and also the player's obstacles on the conflict axis are met, challenged and overcome through hypertextual navigation, hypertext structure supports a prominent function of the computer game, namely that of gameplay. So, instead of creating a tension between the structure and function, hypertextual structure in computer games can support a critical function of the medium.

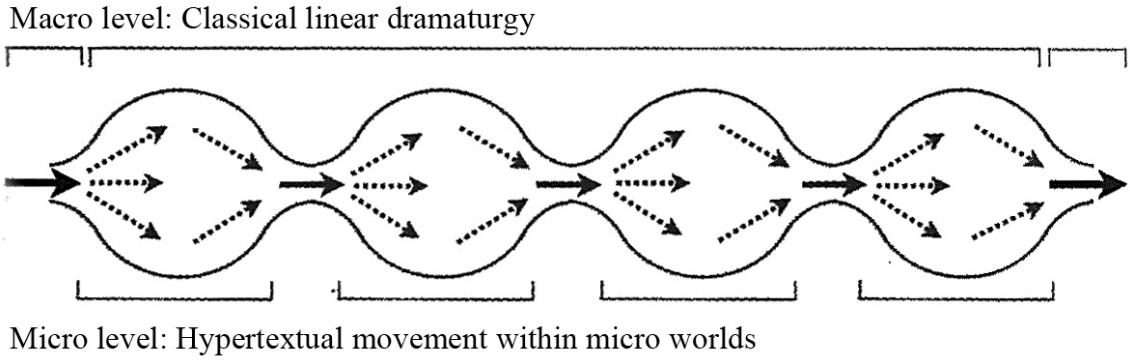

fig. 35: Hypertextual structure within a linear narrative in computer games (Liestøl and Rasmussen 2007)

So to conclude, my argument is that there are fundamental and functional differences between myths and games, an argument reflected by Aarseth when he describes computer games as *the art of simulation*. "Simulation is the hermeneutic Other of narratives; the alternative mode of discourse, bottom up and emergent where stories are top-down and preplanned."(Aarseth 2004, p.52). In light of these differences, a functional perspective might be well suited to assess the appropriateness (or potential) of hypertext.

3.2.2 **Hypertextual landscapes**

This emphasis of the novels or the computer games function to the reader or gamer might seem like a reductionistic generalisation that dismisses subjective interpretation. Nonetheless, rejecting it altogether would be negating a notion of common ground. Furthermore, by this brief comparison of hypertext novels and computer games, I do not claim to provide an exhausting set of reasons to one

medium's potential over the other concerning successful hypertextual implementations. Nevertheless, seeing how hypertextual structure is successfully used in computer games and its limited success in hypertext novels, the case of narratives do not seem to be a deciding factor for the potential of hypertext. However, how the user expects to interact with the medium, reflecting its basic underlying function or purpose, might be highly relevant for a successful hypertextual implementation.

The question for me would then be what the function of a climbing guide is, how does the reader interact with the guide and for what purpose? These questions are further discussed in chapter 3.4 and in the analysis. For now, I will draw on my experience as a frequent user of climbing guides. Though not exclusively, when the climbing guide is consulted, questions involving physical spatiality, proximity and orientation are often posed. Where should we go? How do I get there? What route is this? Where are we now? Where can I find a nice grade 7b+ route nearby? This spatial aspect has an interesting parallel to hypertext theory. Earlier hypertext theory was often engaged with the processes of reading the hypertext, seeing how it differentiates from linear texts. Where linear texts were conventionally read in a predetermined sequenced order from start to end, hypertext was different and thus required theorists to conceptualise the difference in reading. In doing so, a plethora of metaphors were employed:

> "My experience with Intermedia suggests that **navigation** and **orientation** are no longer serious and unresolved problems. Using system features, the reader can **locate** something or **travel** to it by means of [...]. One always knows what documents **'surround'** the document one is reading, and one can always **travel** to **an overview** document, which in most cases gets one off **in the direction** one wishes to head." (Landow 1991, p.83, my emphasis)

This is just one of the many examples of how metaphors relating to physical orientation and movement in material landscapes were used to conceptualise the reading of hypertexts. The metaphors conceived through language are not only expressions meant to shape the way we think, they are initially from the authors mind expressions that reveal mental conceptualisations manifested through language (Lakoff and Johnson 2003). And although metaphors relating to the physical environment is one of the most basic kind of metaphors (Lakoff and Johnson 2003, ch.4), the ones used above are undoubtedly more high level than the most basic metaphors based on our conception of up/down, in/out, front/back.

Gunnar Liestøl points out how Ludwig Wittgenstein, in a description of organising textual production, presents metaphorically how the text should be read in a topographic manner, like moving in a landscape (Liestøl 1994, p.90). Contrary to the linear mode of appropriating knowledge, the body of knowledge is a landscape, the objects of interest approachable from different directions giving different perspectives. Navigating in a landscape as a metaphor for orientating oneself in a hypertext are also discussed in Mireille Rosello's *The Screener's Maps*, where she relates the act of reading to navigating a map or a landscape, and also mentioning Gregory Ulmer's discussion of travel as a metaphor conventionalised in hypermedia rhetoric (Rosello 1994, p.129). If the metaphors of navigating landscapes and topography are the hypertexts equivalent of the classical narratives one-directional line, this acknowledgment can implicate potential of a transformation from linear to hypertextual structure of certain texts.

Returning to the climbing guide, the question is whether the user interface of Crags can accommodate a successful fusion of the mental navigation in the hypertextual landscape and the material navigation in the physical landscape. Additionally, the fusion of moving in two landscapes is quite possibly aided by the use of location-based services. Much of the subject matter in the climbing guide - crags, walls, routes and so on – are representations of physical objects often within view or in close proximity to the reader. Implementing location based services to such objects are motivated by the aim of connecting the hypertextual space to the physical space, hopefully preventing the climber to get lost in either.

Contextualised as a locative media product, a further description of Crags is to be found in chapter 3.3. Before closing the theoretical chapter on hypertext, a brief outline of Crags' hypertextual structure is necessary to better understand the nature of this specific hypertext.

3.2.3 Hypertext structure and patterns in Crags

Due to the dynamic nature of digital hypertexts and the term's broad definition, hypertexts take on many forms and are organised accordingly. In Crags the hypertext is organised mainly as a tree structure, with our physical world as the top-level node and route image comments as the bottom-level node. Navigation within this structure

however is not limited to the tree-like organising[29]. In *Patterns of Hypertext (1998)*, Mark Bernstein identifies patterns occurring in various hypertext structures. From his differentiation of various patterns, Crags is subject to the sieve and the neighbourhood patterns. “Sieves sort readers through one or more layers of choice in order to direct them to sections or episodes. […]Where the choice is informed and instrumental, sieves become decision trees”(Bernstein 1998, p.24). The association and establishment between nodes in the neighbourhood pattern occurs “through proximity, shared ornament or common navigational landmarks”(Bernstein 1998, p.25). In striving for an easily associable coherence between physical and hypertextual navigation, the neighbourhood pattern necessarily reflects spatial proximity. The topo and the map view of crags will in this sense function as a miniature site map to ”inform readers that the lexia in which they appear are ‘close’ in some planned way”(Bernstein 1998, p.25). The route buttons (fig. 18, fig. 20) are also subject to the neighbourhood pattern, as spatial proximity is revealed through the route buttons ordering and labelled numbering, this reflects a left-to-right reading of the topo. Departing this theoretical context of the hypertext, the next chapter outlines a perspective on multimodality. The term is connected to the concepts of modality and mediality, and the rhetoric of multimodality is explained through the theory of remediation.

3.2 Multimodality

Assessing the multimodal potential of Crags requires some description of the medium adapted from and to and their respective modalities. Kress and Van Leeuwen distinguish between modality and mediality, each respectively representing the two agents in a mediated reading, the medium itself and the person engaging with the medium. Modality is defined as the text types, the medium’s capability of expressing, such as music, text, speech, images and video. Mediality relates to which of the five senses are engaged in perception and interaction with the medium (Kress and Van Leeuwen 2001, p.67). Modality and mediality are both useful definitions to investigate how in the process of an adaptation, one medium differs from another. They are useful to highlight and explain potentials and limitations, from which understanding can be built both in the design phase(s) as well as in the evaluating

[29] See appendix 2 and 3

phase(s) of application development. For instance when adapting a map from a book to a mobile device, the user is not just using the eyes to read the map, s/he additionally interacts with the map using fingers to zoom and pan. Interacting with what in essence is the same mode or text type, now necessitates a shift in reading from the monomedial use of vision to the multimedial use of vision and tactile sense[30].

When contrasting the book with the iPhone, their multimodal capabilities differ. The book is multimodal in its capability of containing both written text and images. The multimodal capability is even more diverse on the mobile device because in addition to image and text it is also capable of expressing video and sound. Increased multimodality means increased flexibility in fitting modal capability against medial limitation. For instance, when using Crags as a navigation system in the car, the modality of sound and mediality of hearing does not require the driver to use his eyes or hands for interaction with the medium, thus putting less strain on the tactile and visual senses. As this example shows, designing with these considerations in mind can ensure a less stressful and hazardous reading, thus ensuring a better user experience. However the practical advantage of increased flexibility that comes with increased multimodal capability does not fully explain the enticement of multimodality. A more comprehensive description of multimodality is needed; a theory that can describe its allure and rhetoric both from a historical point of view as well as a phenomenon in contemporary media culture.

A useful perspective on multimodality as a part of the rhetoric of new media is explained by Bolter and Grusin in *Remediation – Understanding New Media* (Bolter and Grusin 1999). This project of adaptation is described by them as an act of *remediation*, a term coined to describe fundamental dynamics of how media are building and referring to each other. They claim that "what is new about new media comes from the particular ways in which they refashion older media" (Bolter and Grusin 1999, p.15), and this refashioning is the act of remediation. Bolter and Grusin also argue that "a medium is that which remediates" (Bolter and Grusin 1999, p.65), making remediation an inescapable dynamic of the evolution of new media. In the processes of remediation, there is a double logic which both promise a greater

[30] To prevent any confusion; in reading a book, the reader will use hands to flip pages, however this is a required mediality of reading a book, not one of reading a map.

authentic use experience. This is the remediated medium's claim for attractiveness over older media. The promise of greater authenticity are realised through the logic of transparent immediacy and hypermediacy (Bolter and Grusin 1999, ch.1).

The logic of transparent immediacy seeks to deliver authenticity by negating the mediated experience, thus making the user forget the mediums presence for what it is representing. Examples of media working under the logic of transparent immediacy are the renaissance painters turn to linear perspective painting in the 16th century, which employed techniques to make the motive be as visually accurate as possible to real world perspective. In remediating these linear perspective paintings, the photograph was a later example also working under a claim to higher authenticity by transparent immediacy. More contemporary examples are for instance virtual reality experiences (Bolter and Grusin 1999, p.24).

Instead of seeking to erase the mediums presence to the user, hypermediacy is acknowledging the mediums presence. Counter to the example of linear perspective paintings, modernist art worked under the logic of hypermediacy by "hyperconscious recognition or acknowledgement of the medium"(Bolter and Grusin 1999, p.38). The graphical user interface (GUI), allowing multiple windows, the juxtaposition of information, buttons, sliders, menus, is another example of hypermediacy. Within the GUI, the user is variously engaging with different media objects before intermediately returning the attention back to the interface. Hypermediacy within digital technology manifests itself most often through multiplicity, allowing for multiple acts of representation. Contemporary hypermediacy offers a heterogeneous space:

> "[...] in which representation is conceived of not as a window on to the world, but rather as 'windowed' itself – with windows that open on to other representation or other media. The logic of hypermediacy multiplies the signs of mediation and in this way tries to reproduce the rich sensorium of human experience" (Bolter and Grusin 1999, p.34).

The adaptation or the remediation of the climbing guidebook to a mobile device could be followed according to different strategies. Prototyping Crags is what Bolter and Grusin calls a translucent act of remediation, where "the new version is offered as an improvement, although the new is still justified in terms of the old and remain faithful to the older medium's character"(Bolter and Grusin 1999, p.46). Like their comparison of the CD-ROM encyclopaedias to the written ones, Crags offers not only text and images, but also video and sound. It seeks to be a climbing guide, albeit an

improved one because of its extended multimodal character versus the book. It is a claim to improvement that works under the logic of hypermediacy, allowing for additional representations.

3.3 Location Based Services

Location-based services (LBS) in mobile media, often described as locative media, have been a subject of scientific enquiry for about fifteen years[31]. However, it is only since around 2007 that the use of locative media has penetrated the consumer market. The iPhone was not the first smart phone on the market, but Apples introduction of the device on the smart phone market had a similar effect to that of the iPod on the mp3 player market; it became immensely popular. Coupled with the introduction of the iPhone App Store, the result was an unprecedented emergence of locative media applications.

Locative media projects takes on many forms. Many of those of scientific interest seem to be the ones combining narratives with location. Examples of these are *Urban Tapestries* (Urban Tapestries)*, 34 North 118 West* (34 North 118 West), *Textopia* (Textopia) and *Narrahand* (Narrahand). In common, they focus on correlations between narrative and location. Combining narrative with location opens up for interesting questions, for instance on how meaning is generated through consumption and production of narratives connected to specific locations. Not denying the value of scientific enquiry with regards to narratives and locative media, Crags has a different perspective. Since the climbing guidebook functions as a reference tool like the encyclopaedia and as such does not include a linear narrative, the implementations of LBS in Crags are based on the notion of replacing or alleviating the work of navigating the text. Crags stands in contrast to the above mentioned projects, where these can be viewed as adding to or complicating the reading by using location as an additional integrated part of the narrative. Crags is instead using LBS in a practical sense to simplify and aid reading habits. Thus Crags has more in common with other reference utilities like the Lonely Planet travel guide applications than it has with experimental locative media projects employing narratives in their research. As for most reference tools, the climbing guide is often

[31] The first well-known locative media project was the Cyberguide project of 1995 (Løvlie 2011, p.17)

read with specific objectives relating to contextual occurrences in mind rather than the leisurely immersion in the narrative. For instance, if the climber is lost driving to a new crag, s/he will look up on the map page with the objective of finding the right way. The focus for implementing LBS in Crags has been how LBS can help under these circumstances.

In a historical climbing perspective, the use of instruments to establish position is neither common nor novel. LBS are not the first technology used to establish position[32]. The quadrant, and its successors the sextant and the octant, were naval instruments used throughout the last millennia for celestial navigation. The compass, used both at land and at sea, relies on the earth's magnetic fields to establish position. And LBS in this instance are relying on GPS satellites and cell phone towers in order to establish position. In the context of mountaineering, navigation by compass was, and still is, a required skill (Cox, Fulsaas et al. 2003, ch.5). However climbing crags are most often located closer to civilisation, and requirements of complex navigation by map and compass are rare. As an act of remediation, LBS are remediating the compass and the octant as a technology to establish position. By effacing the physical devices of the octant and the compass, LBS become an invisible, integrated part of the medium, thus working under the logic of transparent immediacy.

3.4 Climbing as an activity

As the examples of modality and mediality show, when developing computer interfaces that are to interact with humans, it is important to understand the dynamics between the two. As opposed to computer-to-computer interaction, human-computer interaction is less uniform and more complex. To understand the human side of this interaction, theory is arguably at great help, and the field of Human Computer Interaction (HCI) is specialised in this. In order to understand the user of a computer interface in a human-computer relation better, HCI theory can beneficially be employed to model the user in a certain way. One such model is viewing the dynamics of a HCI as the user performing an action and the computer responding with an appropriate (re)action. From this point of view the interface is

[32] Strictly writing, location based services are not a technology, but a composite of technologies used to establish position. However, since they produce the same output, albeit in different granularity of precision, this distinction is not relevant for this discussion

conceptualised as what is between the actions, i.e. the interface is the site of interaction. To better understand what informs or guides the users actions, activity theory can lend us a hand. Originating as a psychological meta-theory on human activities from Russia in the 1920s and 1930s (Engeström, Miettinen et al. 1999, p.1), activity theory has been applied to various theoretical fields such as sociology, psychology, geography, computer science and HCI (Dransch 2005, p.33). In HCI, concepts from activity theory are useful to understand the various contexts of use in concoction with the possible objectives a user might have.

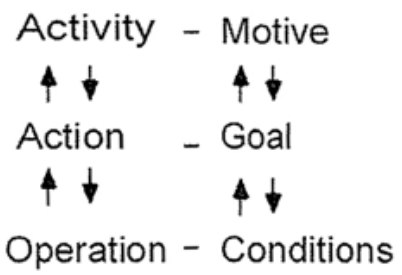

fig. 36: Activity model (Sharp, Rogers et al. 2007. p.400)

Everything we do in our daily life can be viewed as performing activities in different scales and granularity. The original activity model (fig. 36) is hierarchically structured from top to bottom. An activity is understood as a set of actions, again constituted by operations. The top level activity provides a "minimum meaningful context for understanding the individual actions"(Sharp, Rogers et al. 2007, p.400). Where actions are recognised as conscious cognitive efforts, operations require little cognitive attention. For example, one of the actions in the activity of climbing is 'driving to the crag', constituted by the operations of 'driving' or 'taking the bus', pending public transport conditions. But the boundaries of these concepts are blurred and shifting. An action can become an operation, and vice versa, by change of cognitive effort required, and activities can become actions when motives change. It is possible to identify activities "on the basis of the motives that elicit them, actions on the basis of conscious goals that guide them, and operations by the conditions necessary to attain the goals"(Sharp, Rogers et al. 2007, p.400). So when developing an application that acts as a guide to climbers, it is important to understand the user in his or hers activity of climbing. To understand an activity, we can assume that the user in the action of interacting with a digital device is trying to achieve a goal. Due to the complex nature of humans, and subsequently their activities and actions, an action will most often consist of several goals. Conceptualizing the user in such a way helps us understand what the user want from the system within that activity. As a climbing guide, these are some actions (numbers) and goals (letters) that could be expected from a user of Crags:

1. Find out where to go climbing
    a. Find a place that has suitable climbing for me
    b. Find a place that is in the shade in that time of day
    c. Find a place with no precipitation
2. Find the way to the crag I am heading for
    a. Finding the quickest route
    b. Not get lost on the way
3. Find the exact location of a desired route to climb
    a. Making sure it is the right route
4. Check where to find routes at this crag suitable for me
    a. Find routes that fit my skills
    b. Find routes that has high quality climbs

The physical properties of a medium affect how the information is perceived. For instance, a neon sign is not the same as a hand painted sign on a wooden board (Kress and Van Leeuwen 2001, p.69). This implies that the same information is perceived differently when viewed through different media. In activity theory, the dynamics between media, defined as artefacts, and the user as a recipient of information, are brought to a reciprocal level. The user is defined to be within the context of an action and will be informed differently by the different artefacts used to achieve the goal(s) of that action. Reciprocally, the artefacts will shape the user's decisions, goals and ultimately actions and activities. This again affects how the user interacts with the artefacts (Dransch 2005, p.34). Considering each medium's unique aesthetic and the complex reciprocal dynamic of activities and artefacts, chances are that in the adaptation of a climbing guide from one medium to another, the goals derived from the use of a climbing guidebook can change in the transformation process. However, these goals are most probably still useful from an initial stage of development.

One of the key features that distinguish application development on mobile devices from the desktop environment is how we use mobile media to answer questions of spatial character. While questions involving a spatial aspect – such as orientation, navigation and proximity – are by no means exclusive to the mobile environment, they arguably occur more frequently, and more importantly they occur in a multitude of heterogeneous environments. Looking further into the spatial relations of mobile media is therefore highly relevant from a scientific perspective as well as useful in application development. According to activity theory, activities in mobile computing are built from a set of elementary actions concerning spatiality combined with other actions (Reichenbacher 2005, p.142). These are the actions of locating, navigating,

searching, identifying and checking. A reworking of Reienbacher's chart of spatial actions (Reichenbacher 2005, p.144) show how LBS, hypertext and multimodality might assist the user (table 1, next page). The purpose is to examine how properties exclusive to a mobile device can assist users' spatial actions in resolving goals and operations that may arise pending various conditions. These conditions are at large subject to different contexts, and this is the subject for the next chapter.

Spatial actions: hypertext, multimodal and LBS support

	Locating	Navigating	Searching	Identifying	Checking
Questions	Where am I? Where is crag? Where is route?	How can I get to this crag? How do I get from the parking lot to the crag?	Questions answerable by search parameters	What crag do I want to go to? Are there any particularly interesting routes here? Any routes of this grade/style?	Is it dry there? When is it sunny/shady? Is there any particular information of interest on this route?
Objective	Find your position, find location of crag, location of a route	Acquire efficient routing to destination	Display relevant information according to user input	Identify appropriate crag or route	Identify weather conditions. Acquire information of interest related to route.
Service	Deliver position of yourself, crags, routes	Deliver route suggestion by map and text	Deliver list of suggestions with sorting options	Deliver map of crags, deliver listing of routes, deliver images and videos of routes	Deliver the state of precipitation, the state of a route
Parameter	Coordinate, crag, route, wall	Your coordinate, destination coordinate, access information	Search parameter(s)	Crag, route, style, grade	Time, precipitation, other route conditions
Support	Orientation in space	Finding the way through space	Information about real world objects of the usage situation	Information about real world objects of the usage situation	Finding relevant events, information about the state of real world objects in the usage situation
Hypertext, Multi-modality, LBS	**Hypertext** (segmentation of information), **LBS** (locate you, locate route)	**Hypertext** (map service), **LBS** (your position)	**Hypertext** (segmentation of information/searchable tables, syndicated weather service), **LBS** (radius as search parameter)	**Multimodality** (images and videos of routes), **hypertext** (segmented information).	**Multimodality** (visual feedback from images and video on rock quality and route characteristics), **Hypertext** (segmented information, weather service syndication)

3.5 Contexts of use

Conceptualising and analysing a users actions and activities is a way of creating an image of how the user will engage with the medium. In modelling this image it is important to take into account that the user is neither isolated from, nor unaffected by the enclosing environment. Activity theory states that an action is always performed and to be understood within a context (Reichenbacher 2005, p.146). In HCI there are various definitions of context. Chen and Kotz describes context as: "the set of environmental states and settings that either determines an application's behaviour or in which an application event occurs and is interesting to the user"(Chen and Kotz 2000, p.3). Dey describes context as "any information that can be used to characterize the situation of an entity, where entity means a person, place, or object, which is relevant to the interaction between a user and an application, including the user and the applications themselves"(Dey 2001, p.2). Shilit defines more specifically that context can be divided into computing context, user context and physical context, later elaborated and worked into a scheme of context categorizations for mobile map services (Sarjakoski and Nivala 2005, p.117). By examining the user's action goals and spatial actions, it is possible to determine how the physical context will affect the application, and therefore should be taken into account in the design.

Mapping the physical contexts of a climbing guide, the user's activities take place in mainly three different locations. Firstly, the guide is used in a planning stage, e.g. at home. Secondly, the guide is used on the road mainly for navigating to the crag. Lastly, and perhaps most extensively, the climbing guide is used at the crag. These three physical contexts are not homogenous with regards to computing contexts. Many mobile applications are designed to work within a more homogenous physical context. Examples of this are real-time commuting information systems designed for use in an urban environment (for instance Trafikanten sanntid 2010), or a map service for visitors to a national park designed to use in a location where there is no network connection (Death Valley 2010). A closer look at the physical contexts and their relation to the computing contexts in Crags reveals different states of network connectivity, as shown in table 2.

Computing Context: Network Connectivity			
Physical Context	**At home**	**On the road**	**At the Crag**
LBS	✔	✔	✔ / ✗
WiFi	✔	✗	✗
3G / EGDE	✔	✔ / ✗	✔ / ✗

table 2: Physical context and network connectivity

At home, LBS are usually available either through GPS or WiFi/3G triangulation, and Internet services are also available through WiFi or 3G. On the road, LBS are at hand through GPS or 3G/EDGE triangulation, and Internet services are available whenever the user is within 3G/EDGE coverage. At the crag, network connectivity is subject to different conditions. Climbing locations are to be found in rural areas as well as close to urban environments. This means the availability of a 3G/EDGE network is uncertain. The availability of GPS coverage is usually not a problem outdoors but may suffer from blockage by surrounding landscape features (most often the crags used for climbing). Relatively urban areas with usually good 3G/EDGE coverage, may also suffer from the issue of blockage by climbing walls.

The various options of connectivity in these three physical contexts have fundamental implications on the application design as it limits or enables the use of certain features[33]. As Internet and LBS services are variably available in the physical use contexts, one way to bypass this problem is by not using these features at all. Yet, as figure 3 shows, these features *can* assist the users in their activities. As they are features that might be of assistance whenever they are available, I propose to design for making use of these features when available and letting the application degrade gracefully whenever they are not. That is, letting the application be as functional as possible without these features.

3.6 Concluding remarks

Performing research on emerging mobile technologies, the technological features can be viewed from two perspectives. One is viewing a technological property as an enabling feature, for instance the possibilities that opens up when LBS is combined

[33] By example, my earlier outline on database implementation (ch. 2.3.1) shows how computing contexts are affecting design.

with other features, increased screen size, new modes of device interaction like touch screen or voice control, or new possibilities of 3D-modeling on a mobile device. Likewise, the same technological property often has an aspect constraint, for instance limited network connectivity and hence access to LBS, display real estate constrictions, the challenges of using voice control in a noisy environment, or the limited processor capacity to render processor demanding 3D models.

In the more theoretical branches of science, the enabling perspective arguably lives in danger of being favoured to the constraining one. This might be due to that practical limitations and constraints sometimes are invisible (or at least hard to imagine) before they suddenly arise in during actual testing or use. Another contributing factor to the favouring of an enabling perspective might be the notion that constraints, sooner or later, will be overcome by the never ending advances in technology and therefore are less interesting, at least in a long term perspective. In other words, a general interest in investigating tomorrow's possibilities than today's limitations. As a counter measure, a synthetic/analytic approach can help balance the two perspectives, since one in the synthetic process has to take into account the constraints as well as the possibilities of the technology at hand.

Moreover, theory provides an insightful context to the production process. The common tradition in humanities is to apply theory after the fact by conducting a scientific enquiry on a past event or phenomenon. Within a practical/theoretical framework of scientific endeavour, theory can also be usefully employed in a forward perspective. In HCI the design process is iterative, switching between conceptualising, designing, testing and evaluating (Sharp, Rogers et al. 2007, ch.9). Rather than being applied just after the fact, theory can partake in the hermeneutic cycle of knowledge building, similar to the cyclic design process of HCI. As the chapter on hypertext as well as the theory of remediation shows, a thorough understanding can reveal the specific differences between the medium adapted from and the medium adapted to. The insight that this gives can be employed to actively make use of the advantages that lie in these differences. Modelling usage situations by the help of activity theory creates an image of different usage situations with their possibilities and constraints. And by using theoretical concepts like modality and mediality, the multimodal potential of the medium adapted to can hopefully be put at its best use in meeting these possibilities and constraints.

These three chapters so far have all given their respective contexts to the digital climbing guide. Where chapter one provided a historical context, chapter two detailed the development process and specific design implementations and chapter three provided a theoretical context. The next chapter will describe the user test of Crags and the subsequent information found through my informants' responses.

4 Testing and findings

This chapter covers the methodology, the field test and the analysis of the feedback provided by my informants. Before moving more specifically into analysis, I will provide a description of the methodological approach and the field test conducted. In the analysis, some general observations and remarks are outlined before I analyse the response given by my informants. The analysis is respectively divided into chapters concerning hypertext, multimodality and location-based services.

This thesis initially set out to inquire the potential of the social aspect of Crags in the context of adaptation. Due to practical limitations, this was not included.

4.1 Methodology

Scientific endeavours in the humanities are usually performed retrospectively, in other words, enquiries on a past or contemporary phenomenon. Even so, there seem to be valid reasons for the humanities to partake in production-based research. Liestøl's call for a synthetic/analytic framework of study is partly based on the worry that the one-directional retrospective relationship between scientist and subject matter in analysis and interpretation, is unable to keep up with the rapid emergence and changes in new digital media. "This limitation of traditional humanistic analysis also affects analytical and interpretative practices themselves. When differentiation, complexity, and speed of change increase at the same rate as subject matter, the existing repertoire of analytical means is in danger of becoming inadequate and obsolete"(Liestøl 2004, p.390). Not only the pace of innovation, but also other peculiarities of digital media have called for a change in existing research traditions. Expanding on Espen Aarseth's claim that computer games cannot be read as texts in order to be understood properly, instead they must be played, Stuart Moulthrop argues that a defining feature of digital texts is that they require active participation for a thorough understanding of the media involved (Løvlie 2009, p.253). Following this claim, in order for me to understand and examine the potential of unique properties to a medium within a process of adaptation, a participatory role as a climber and designer in this process is beneficial, if not crucial. My approach is a hypothetical inductive one, highly acknowledging the subjective nature of this undertaking. The research questions are open ended, reflecting an explorative

perspective on the task at hand. Not only utilising inductive means to knowledge production, both the production phase of this project, as well as the thesis as a whole, has the characteristic of abduction. This is described as "to move from a conception of something to a different, possibly more developed or deeper conception of it. This happens through our placing and interpreting the original ideas in the frame of a new set of ideas [...] all abduction builds on creativity and imagination"(Danermark et. al. in Schrøder 2003, p.46). In this way, as an act of abduction realised through production, the process of adaptation is to place and interpret the contents of the guidebook in the frame of a new medium. Abduction also happens on the more abstract and theoretical level. In the case of hypertext for instance, from the initial somewhat ambiguous hypothesis of examining the potential of hypertext, I developed a deeper conception and a certain framing of the text structures and the modes of thought in order to evaluate the linear structure against the hypertextual structure. The concept of abduction encompasses the acknowledgment that discoveries can be made without being facilitated purely by inductive or deductive reasoning and chains of causality. It provides space for creativity, imagination, the unexpected and the unforeseen. These are clearly aspects of practical research that needs to be taken into account[34].

Aside from my own experiences and reflections throughout designing and testing Crags, data are gathered through qualitative means. As there is no established research methodology for practical/theoretical research in the humanities, the choice of methods for data gathering do not necessarily stem from any academic imperatives. The choice of methods was based on methods used on similar projects[35] and on the basis that they are preferred techniques within HCI (Sharp, Rogers et al. 2007, ch.7, ch.10.4). The focus in HCI – developing good user interfaces, or good design – is slightly different from mine. However, these techniques seemed the most appropriate and also, as a premise for proper scientific execution of any research method, manageable in order to adjust the workload to what one can achieve in the given time frame.

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[34] In this sense, abduction is related to other terms used in academic circles to describe the unforeseen, such as *tinkering* (Denzin and Lincoln 2005, p.317) and *serendipity*, a term slightly oxymoronic termed by some as the 'happy accident' (Meyers 2007).
[35] For instance employed in Gunnar Liestøl's Situated Simulation project testings (to be published in the Journal of Digital Creativity, forthcoming 2011)

A further argument for utilising concepts from HCI in production-based research is the alignment of perspectives on knowledge production. As a way of producing knowledge, the dominating paradigm of knowledge building within HCI – the user-centred approach[36] – is reflected in qualitative research. Although universal design principles for generating good designs exists, the nature of a user-centred approach, actively involving the user in the iterations of prototyping, implies the designer alone is unable to account for successful interface design. Involving the user means preventing potential discrepancies between the designer and the user as identified by Donald Norman (fig 37). The involvement of users in the design process implicates the acknowledgment that good design is reached through consensus. This means that good design is as much subject to the specific design object as much as universal design principles. Although there are models and frameworks at hand for the interface designer, involving the user in each design case acknowledges the need to account for the specific and furthermore supports the claim that universal design principles will only get you that far towards the finished product. This perspective is much reflected in qualitative research. Contrary to quantitative research's statistical probability, knowledge in qualitative research is reached through consensus, and where external generalisation is often subjugated to the specific case.

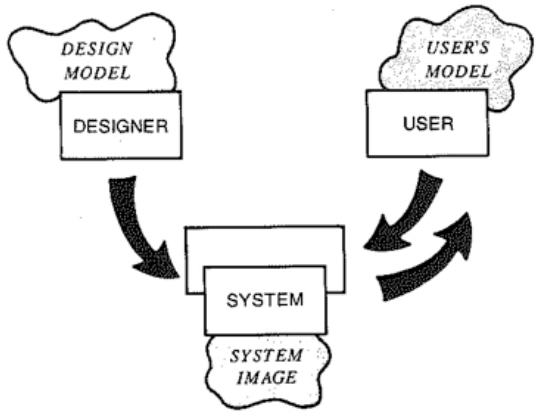

fig. 37: Different mental models of a system (Norman 1988 , p. 190)

The two-year process of development is an integral part of the production of data for analysis. The process builds my own understanding of the subject matter and is inextricably linked to the data outcome as it forms the basis of the informants' experience of Crags. Preceding the user test, I conducted a pilot test and several field excursions. The main user testing was conducted with seven informants between the age of 23 and 33, all climbers who are friends and acquaintances from the local climbing community. Using questionnaires and three semi-structured focus group interviews enabled triangulation of data. These techniques were valuable both for

[36] See for instance (Sharp, Rogers et al. 2007, ch. 9.2.3)

measuring my own assumptions realised through prototyping, as well as in providing useful feedback and suggestions to improvements for further development.

I have been very aware that using friends and acquaintances as informants might bias their replies. On one hand, an informal relationship can obviously bias the response as personal feelings towards the researcher affect (to a certain degree) informants replies. Conversely, informal relationship can have its benefits. The informants' relationship towards me might make them feel more at ease and free speaking than what they would otherwise, especially since there is no sensitive information involved. Also, in acknowledging the subjective and interpretative nature of qualitative research, my knowledge of personality traits and ways of communicating arguably provides me with a broader foundation for interpreting the informants' replies. Nevertheless, I have sought to counteract the possibility of biased replies as well as biased interpretation by relying little as possible on statements simply expressing a positive or negative experience connected to design and functionality. Although statements weighting an experience in a positive or negative direction are used and interpreted, I have made efforts to not draw conclusions based solely on a statement's positive or negative weighting but as much as possible in combination with the content of the statement. For instance, if an informant claims that the driving directions function is useless because of the display size, I have focused more on the problem with display size rather than the matter of uselessness.

Following the user test held, there have been mainly three sources of data. Firstly, from a questionnaire containing 37 questions[37], secondly, from an unsupervised group discussion[38] in two groups of three informants, and conclusively a focus group interview[39] held with all six informants[40]. These three sources were all recorded with audio and video, which were after transcribed for further analysis. I could have extended data triangulation, had I sufficiently recorded the field test, unfortunately this was too labour intensive in the midst of administering the field test. Besides triangulation, I have sought to increase internal validity by utilising member checks,

[37] Written in best effort to be as neutral as possible in their wordings, and as a mix of multiple choice questions and open questions, see appendix 7.
[38] The informants were given three questions they had around fifteen minutes to discuss. For the questions and the replies, see appendix 8
[39] Transcribed into appendix 9
[40] There were seven informants attending the user test, however one of the informants was unable to partake in the interviews.

by extensive immersion in the data gathered and by detailing sufficient reflexivity, that is the "conscious experience of the self as both inquirer and respondent, as teacher and learner, as the one coming to know the self within the processes of research itself"(Lincoln and Guba 2003, p.283).

4.2 Testing Crags

Throughout development I was continuously testing, modifying and improving the various functionalities. To test the location based functionality, I made somewhere between five to ten trips to various crags to test both coverage and functionality. Of these excursions, one was made with guidance counsellor, and two trips were made with a fellow student to simulate and prepare for the main user test. These trips revealed irregular coverage of both 3G, EDGE and GPS with different carriers, at different times of day and during different weather conditions. In light of these irregularities, I would like to make a preliminary proposal to utilise a local/remote division of content for Crags (see also ch. 2.3.1). This division of content is elaborated on and visualised in appendix 6.

The excursions with guidance counsellor and fellow student gave valuable input to user interface improvements. The latter excursion was done as a pilot test of the user testing to be held, and it gave useful input to improvements of the survey prepared for my informants. The main user testing was held on October 21st 2010 with one fellow student as co-administrator and seven testers. The testers met up at an appointed location in downtown Oslo and got 15 minutes to explore Crags before continuing. They were then told to use the application actively for driving directions on their way to a nearby crag by car. Arriving at the crag, the testers were then given the following set of tasks as a means to help exploring the application:

1. Use the application to find two routes of the desired grade
2. Upload a picture of two routes
3. Make a comment to a picture
4. Explore the application further

After testing the devices on location, the user survey continued with a questionnaire each participant filled out. The participants were later divided into two groups discussing three questions. Finally the groups were put together again, and we had a

semi structured group discussion regarding the previously discussed questions and other questions by my guidance.

4.3 General observations and remarks

We had four iPhone 3GS devices and one iPhone 4 available for testing. When testing the GPS Locator, the devices gave different results, backing up our own experiences when testing three of the devices two days before. Two of the iPhones' the GPS Locator would not update itself continuously as it should after the initial response triggered by the user. The rest of the devices did not have this problem, but they gave different location accuracies. Since the GPS Locator feature is seeking to assist the user within a very small geographical area, high accuracy is key to the user experience. It is unknown why devices of the same brand and model, which were used simultaneously at the same location, gave different results. However the iPhone 4 provided good location accuracy continuously. Whereas accuracy on the iPhone 3GS was at best 5 meters (but mostly 14 or 23 meters) the iPhone 4 showed much stronger signal, continuously updating the location, and giving an accuracy of 3 and 5 meters throughout the testing.

The informants were given a set of tasks they accomplished successfully. There are however a couple of remarks on the course of testing. Firstly, one car (two informants) probably did not use the driving directions function (figs. 27 & 28) for finding their way. Instead, it seems they used the crag overview map (fig. 10). This led to confusion and misdirection as the parking and the crag itself are located some distance apart. Consequently, the response in the questionnaire from these informants was not very relevant to some of the questions, which in turn resulted in less data. I probably could have prevented this by giving more specific instructions. At the same time, I did not want to be too specific in instructing the informants, as I wanted their own exploration of the application to serve as the basis of response. Giving them too specific instructions could for instance have affected their experience of intuitiveness of the application.

Secondly, there was a bug in the driving directions step-by-step panel, which prevented it from updating itself when driving directions were refreshed. It led to confusion when Henning and William were trying to follow directions using this

panel. This incident was the only report of the application crashing during the test, as they responded in question 1.7 and 2.2: “on one occasion I had to reload the driving directions/map in order to update ‘current’ position” (Henning, q.2.2, my translation[41]).

In chapter 3.5, I was outlining purposes and goals for using the climbing guide based on my own experience. The replies from my informants confirmed these assumptions[42]. All informants responded *planning* as a main purpose, and *finding routes* was also often mentioned as a purpose of use. In addition, three informants described situations indicating leisure as the motivation for reading climbing guides. Other purposes describing the use of the climbing guidebook were as a reference tool in discussions and as a collector’s item.

4.4 Hypertext findings

The reading of the hypertext is necessarily a mediated one. The mediated interface – although inspired by conventions such as those provided by the Apple[43] and conventions of iPod music navigation – is to a large degree a product of my own design skills and choices. Assessing my level of competence as an interface designer has not been a subject for this thesis. However, I wish to make the point that the user experience of reading the hypertext emerges from my design choices, skills and faults. Assessing the potential of hypertext in contrast to the reading of the paper-based book can therefore be biased by the degree to which I have made intuitive and ‘good’ design choices. Since the user interface design and hypertextual implementation is inextricably intertwined, feedback from the informants relating to the user interface navigation is reflected upon as aspects of the hypertextual potential.

As stated, all of the informants accomplished their tasks with ease, and their responses regarding ease of use reflected this in many ways. When asked what they liked best (q.1.5), informants stated: “Easy and intuitive to navigate the application”

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[41] All further replies in Norwegian are translated to English. Also, future references to questions from the questionnaire are referenced to and abbreviated with the prefix q, e.g. (q.1.5)
[42] Based on feedback from question 1.4: In what different situations do you usually use a climbing guide? (e.g. what places, for what purpose)
[43] Apples Human Interface Guidelines, guidelines provided by Apple for a ”consistent visual and behavioral experience across applications” (Apple Inc. 2011)

(Vibeke), and "Especially liked the graphical user interface" (Henning). And when asked about how the informant experienced using Crags (q.1.9), response was: "Have not touched the iPhone [before] and it was intuitive and ok" (Kyrre, my brackets), "Easy to understand and use" (Vibeke), "Little details that I eventually (quickly) understood, made the experience better" (Christer), "At first strange to use a phone to find a route […]. But after a little while I got used to the iPhone and I could totally use and apply Crags to find the route" (Tobias, my brackets), "I was very impressed. Simple layout. If I was ever confused, I figured out a solution quickly" (Matthew), and "Good for a prototype!"(William). The comments reflect ease of use and steep learning curves among the informants, who were variably experienced in using touch sensitive smart phones[44]. These comments point to what I most subjectively will call an *adequate standard of design* for some measuring of hypertextual potential.

The informants' responses include suggestions for improvement on the hypertext[45] where the biggest concern relates to the possibility of extended hypertextual movement. Several of the informants supported the view that navigation within a crag had: "too many levels (many clicks) some places"(Henning, q.1.9), indicating they wanted additional and more efficient ways of navigating between the nodes. Suggestions for improvement were a *home* button, an option to switch directly between route info panels and an option to access the topos from the list of all routes. Such implementations will add complexity to the hypertextual network of nodes and links[46].

From the user test, it emerged that the two most pressing issues in navigating the hypertext are to identify routes from the topo and the navigation between the topo and the route information. Part of these issues is caused by the limited visual reading space on the iPhones 5 x 7 cm display. When asked about what they liked the least (q.1.6), two replies were: "smaller image than [in] book and route info is not on same page"(Kyrre, my brackets), and "Small screen to get good overview" (Tobias).

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[44] I have not made further judgements on the basis of the users' experience and the implications this has on their response. It can be argued that someone with a lot of experience with iPhones and its applications would be better equipped at reading and interacting with Crags than someone inexperienced, so that more experience equals greater ease of use and intuitiveness. Conversely it can be argued that a lot of experience equals higher expectations and a higher critical judgement of the interface design

[45] The structure of the Crags hypertext and its navigational options can be viewed in appendix 2

[46] See visualisation of added hypertextual navigation, appendix 3

When asked about the ease of navigation between topo and route info (q.4.6), one informant "could not easily move from route info to topo"(Vibeke), another stated it was ok, but that it "would be nice to click a route and have a button to go directly to route on topo"(Matthew). Tobias also suggested this in the questionnaire (q.1.8) and elaborated on this during the first group discussion. When discussing the question of envisioned functionality, he proposed to have an "Interactive topo, put your finger on the line and the app boom, automatically: 30 meter 7+"(Tobias 05:10[47]), a suggestion that was welcomed by the others. Instead of using topos, William suggested creating an augmented reality solution (q.1.8) by combining video feed from the iPhone video lens with the GPS to display overlay information on the display[48].

Also, hypertext navigation is linked to the use of LBS. A common scenario of navigating the hypertext would be to stand in front of a wall and figure out one's location with respect to the routes that are directly in front of and to the sides of that location. In this context, the processes of navigation and identification using route info and the topo in the hypertext are connected to navigation and identification of their physical entities, namely the wall and the route. By the creation of information webs – an idea stretching all the way back to Ted Nelson, Douglas Engelbart and Vannavar Bush – locating specific information was foreseen as an easier task in the hypertext compared to the book (Yankelovich, Meyrowitz et al. 1991, p.55). In utilising LBS to create a link between physical and hypertextual objects, Crags uses this technological attribute to locate specific information and position the user in the hypertext by the display of such information on the screen. The potential of using LBS is thus linked to hypertextual navigation. Elaboration on the potential of LBS is further discussed in chapter 4.8.

[47] All future references to audio recordings refer to the last group discussion with all informants, unless it is explicitly stated otherwise, as it is in this case.
[48] One example of such an AR product is the Gule Sider iPhone application, a video of their AR functionality available here: http://www.youtube.com/watch?v=4jnGY6qFPxg

4.4.1 Dynamic content

> ”There is no way to directly refute a text. After absolutely total and devastating refutation, it says exactly the same thing as before. This is one reason why ‘the book says’ is popularly tantamount to ‘it is true’. It is also one reason why books have been burnt. A text stating what the whole world know is false will state falsehood forever, as long as the text exists.”(Ong 2002, p.78)

Like Walter J. Ong points out, paper-based texts have a certain permanence. The nature of digital texts is in this sense quite different from those applied to paper. Digital texts are less resistant to change, since they are ultimately stored as binaries on a hard drive designed for writing and rewriting. Effectively, there are many implications to the changing nature of digital texts. Content can be added or changed; content can be represented according to a user’s preference; linking to external texts are simple to perform; and different representations of the same information are easily constructed.

The ability to add, change and update information as physical conditions may alter on a route were seen as a positive trait to Crags as it enables climbers to make warnings like “bad bolt/anchor, loose block” (Matthew q.3.4). When asked about what they saw as the greatest advantage of the digital climbing guide (q.5.5), three informants emphasised the possibility of easily updating information. Also, when discussing distribution and pricing models, the informants seemed to agree that the best option would be to pay per crag, effectively including content/crags according to need. There was a unison liking of the camera feature, here viewed as the act of adding to the hypertext, and the informants also wanted the option to make notes, mark routes as favourites or as a note-to-self, and being able to tick routes off on a tick-list.

Some acts of adding or changing content – such as taking photos, making notes, marking favourites and managing tick-lists – have a decisive aspect of personalisation about them. The option to alter content was acknowledged by Yankelovich et. al., who goes on to discusses how readers might be able to filter content according to their preference (Yankelovich, Meyrowitz et al. 1991, p.57). Utterances reflecting this trait were, for instance, on the list of crags: “you should be able to sort them (the crags) in one or the other way” (Vibeke, my parenthesis). During the discussion, three informants said they wanted a search function. This is a

feature that can be viewed as personalisation of information that is displayed because the result is based on the users input.

Conversely to sorting and searching, the digital text can just as easily conform to non-user input. Another example is Matthew's wish for a this-day-in-history feature[49]. Another example of changing texts is the weather forecast, which always gives an updated forecast five days ahead. The weather forecast is also reflecting part of what Nelson and Engelbart envisioned in the hypertexts ability to create webs of related information (Yankelovich, Meyrowitz et al. 1991, p.55). By granted access of the content provider, I was easily able to make the weather forecast an integrated part of the hypertext. This was welcomed by four of the informants; two did not reply; one deemed it unnecessary. Map material was also syndicated from Google Maps, and further implementations of external content were suggested by Christer (q.1.8) to link up with 8a.nu, a web site where it is possible to tick off your achievements in order to be ranked and to compare yourself to others.

Creating multiple representations of the same piece of information is made easy with digital texts. In no way is this a trait reserved for digital texts as this was the essence of Gutenberg's printing press, but the flexibility of digital texts distinguishes it from text on paper in regards to multiple representations. Like Landow points out, this is a fundamental difference of digital text to paper based texts, where "certain forms of text presentation software use the coded, virtual nature of this form of writing to expand and contract the text itself, generate dynamic tables of contents, and otherwise generate text on demand"(Landow 2004, p.37)[50]. One example of this is what Christer proposed in having an image gallery for the whole crag (Christer 46:10). If the climber wants to check out the rock quality or just how the crag looks like, by using this feature, s/he does not have to go through a specific route or several routes in order to view images. Such an image gallery could then contain a list of all images or be automatically generated as a subset of all the images on that crag.

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[49] Mentioned in the first, smaller group discussion, (07:20)

[50] In a footnote, Landow relates this quality to Ted Nelsons concept of *stretch text* (Nelson 1967; Landow 2006, p.93). The reader, contrary to being lead to another node in the hypertext, is in stead expanding and contracting the node itself with the information in contains. The crag charts acts on the logic of stretch text, it can be thought of as an intermediary between the information available on the crag map or list, and the information available upon navigating to a crag.

Another example is multiple instances of crag charts. From the questionnaire and group discussion, it emerged that the informants wanted the overview charts of crags they were used to from the guidebook, i.e. tables with statistics on the quantity of routes, difficulties, grades, styles and so on[51]. When the informants in the group discussion were questioned about the map view versus the list view of crags (fig. 9 vs. fig. 10), Christer said "I find the list in books quite useful, because the list usually have how many routes, sunny crag, is it steep or how long is it to walk"(Christer, 26:00), where upon Matthew replied "Since it is digital, it can be at both places at the same time [...] if you are going through the map and click on something, it could be nice to have a way to get the same detail" (Matthew, 26:00). As Matthew states it is possible to display the same information (such as crag charts) in several places, and in several ways. Furthermore, the list view and the map view are, in itself, an example of a double representation. The crags are presented as a column of buttons sorted by name in one instance, and as markers on a map in the other. Based on the same table in the database, information is selected, formatted and presented accordingly. Since the data is of same origin, changes in the database will be reflected throughout the hypertext where the information is displayed.

4.4.2 **Mode of thought**

As I described in chapter 3.1.3, assessing the potential of hypertextual implementation can be related to a mode of thought analogous to moving in landscapes. The map view and the list view of crags are two representations of the same content. Although there are discrepancies to the sum of information presented in both views, both are presentations of crags that respectively represent landscape reading and linear reading. When asking the informants what situations they preferred either map view or list view (q.4.2-4.4), I tried to uncover some of the mental preconceptions they might have towards either. The informants were in unison in that both views were important and had their advantages over the other. Map view was found useful when the user is locating information in context with geographical orientation, as for instance when "new in the area, get an overview of where things are relative to you"(Kyrre), "to find out which crags are in close proximity to each other"(Vibeke), to "find something nearby in new places"(Christer)

[51] See figs. 5 and 6 (page 9 and 10), grade chart and wall characteristics

or “I forgot the name of the crag, but remember where it is = map”(Tobias). List view was preferred in situations where both crag and location was known. With one exception[52], the informants preferred a list view in situations where both crag and location are known and there is no need for geographical orientation. Although the reasons for the preference of list view were not pursued, this might be at least partly due to the higher cognitive effort it is required for geographically surveying the map, rather than for browsing to a specific crag in a list sorted alphabetically. This suggests relevance of employing linear structures, also for an application where use is frequently concerned with geographical surveying.

Although this thesis stresses the hypertexts departure from linear reading, linearity is not absent. The hierarchical tree-like hypertext structure in Crags is open to a linear reading, and some of the elements are deliberately designed for a linear appropriation of content; this is done with intent to provide clarity and coherence between interface elements so that the climber can make informed choices by sifting information. Occurrences of linearity are thus connected to Bernstein’s already mentioned characterisation of the sieve, where informed and instrumental choices guide the reader in a decision-tree (see ch. 3.1.3). In Crags, the overview panel has buttons arranged from top to bottom (fig. 12). The linear logic represented by the arrangement of buttons follows how far you are in the process of a day of climbing. It begins with directions to the crag, introductory information to the crag, and then a sectioning that follows how a crag is divided into walls, wall maps and routes before at the end, where one finds the weather forecast. To a large extent, this by no coincidence also follows the structured order of climbing guidebooks. The possibility of navigating in the order of crag/wall/wall map/route also represents a linear ordering from largest to smallest unit[53].

As previously described, the climbing guide is mainly a reference text. Its characteristic as a utility tool is for instance apparent when viewing the informants’ replies of planning as one main purpose of use. Drawing on the metaphors of navigation, planning is also a form of orientation. Planning the next step with

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[52] Vibeke argued for the advantage of list view if it is listed by parameters such as proximity, routes, grades, and weather conditions. The application conforming to user preferences by sorting options thus represents the user as orientating herself in the hypertext, and is in many ways alike to a search function.

[53] See appendix 2 (hypertextual navigation in Crags)

questions such as “where should I go, what should I do?” are solved by surveying the landscape regardless of whether the landscape consists of rocks, quantum physics or cake recipes. Arguably, a hypertext can provide ease of movement through the information landscape. In the context of utility, ease of use and quick accessibility to the information you are looking for are sought after characteristics[54]. A hypertext can then provide shortcuts in the landscape[55]; it enables quick accessible information through which the user can move back and forth.

4.5 Multimodal findings

In comparing the use of images in the book with image implementations in Crags, there are some fundamental differences. In the guidebook, there are a limited number of images due to cost of print and size of book. This is not a limitation for digital images. Disregarding the difference in size, the experience of viewing an image materialised in two different mediums can also make up for separate experiences of perception[56]. When questioned on the biggest negative aspect of Crags compared to a book, Vibeke stated that: “digital images/media are unable to give the same level of inspiration as printed images/books”(Vibeke, q 5.6). Not only can the perceptive experience differ, other properties of the photo such as adding images (the opportunity of actively contributing as opposed to passively viewing) and the related traits of personalisation and immediacy contribute to a different user experience and use of images in Crags.

When the informants were asked about the possibility to *add* images to a route (q.3.1), all seven informants were positive to the camera feature. Vibeke and Tobi explicitly mentioned personalisation as a positive trait. Henning also stated that images ‘sell’, probably referring to the inspirational aspect of viewing images. When proceeding to ask about what value/use they saw in viewing images, he wrote: “largest value: inspiration to climb routes, easier to find a specific route and solution”(Henning, q.3.2). Henning found it important that a photo is immediately uploaded after it is captured (Henning, 41:20). In total, five informants mentioned

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[54] An argument supported e.g. by Henning’s complaint of “too many clicks” (see ch.4.4)
[55] See appendix 3 (added hypertextual navigation)
[56] As pointed out in *Multimodal Discourse* (Kress and Van Leeuwen 2001, p.69), see also ch. 3.4

route finding as a key value. Three informants stated beta[57] as use valuable usage for images. Two of the informants mentioned sharing with others as a value for capturing and viewing images.

The topo is a central part of the guide, which means its modal aesthetic deserves some attention. From the questionnaire and the discussions, I received a lot of feedback on its qualities. In the introductory questions on the questionnaire when asking what they liked the least (q.1.6), two informants wrote: “smaller image than in book”(Kyrre), and “small screen to get good overview”(Tobias). When later asking if it was hard or easy finding when a route from the topo (q.3.5), there were two complaints about the quality of the topo, two informants stating that the image was too small. It should also be noted that three informants mentioned the convenience of the GPS Locator for easy route finding.

As Kyrre points out in the questionnaire, the topo of Crags compared to books is undeniably smaller in size. Possible compensation to this downside must be to utilise the unique possibilities of images in a digital environment like Crags. As mentioned, the GPS Locator can help the climber with orientation; this is discussed further in the next chapter. When I asked if the option to zoom the topo in order to get more detail would be positive (25:10), some informants replied that it would while others emphasized the danger of ‘getting lost’ in the image when zooming.

Another possible enhancement mentioned was having an enhanced touch responsive topo that gives more visual feedback in order to provide better correlation between topo and route info. For instance, the route that is apparent by the button displayed at the bottom of the screen can be highlighted on the topo (fig.37). Conversely, when touching the outline of a route on the topo, the route can be highlighted and the corresponding button would slide into view in the topo panel[58]. This would possibly help link the topo to route information, reflecting the issue Kyrre mentioned when writing “smaller image than in book and route info is not on same page”(Kyrre).

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[57] To get beta is to receive tips on how a route is climbed, in order for the climber to have beforehand knowledge on hard sequences, potentially technical parts and other useful information when ascending a route. The awareness in the climbing community of the advantage to be given beta can be exemplified by this distinction: If the climber manages a successful ascent on the first try of a route, it is recognised as an *onsight* if no beta has been given, and as a *flash* if the climber has received beta.
[58] Such implementations have been utilised in climbing applications, for instance to be found in recently developed climbing applications such as the Red River Gorge climbing application (Wolverine Publishing 2011)

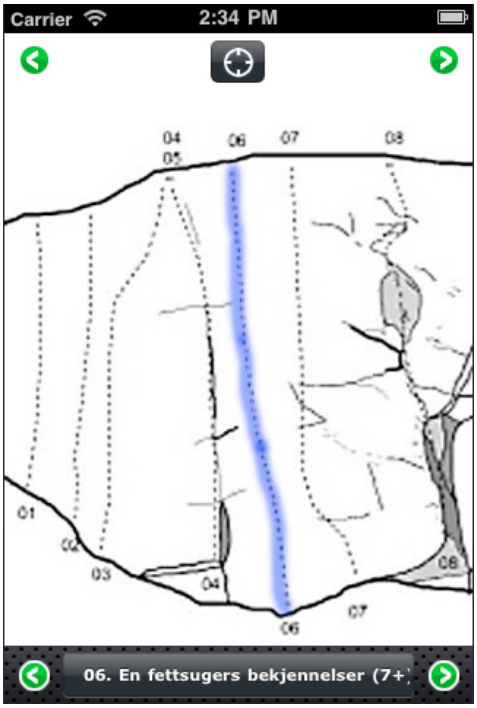

fig. 37: Possible enhanced touch responsive topo visualisation

Lastly, it was suggested that an augmented reality implementation could be a substitute for the topo. In asking what feature is most lacking in Crags, William wrote "that you could have an overlay with route maps combined with 'live view'"(William, q.1.8). In the frame of the theory of remediation (see ch.3.2), the basis for this representation's claim to improvement over the existing representation of the topo and its routes can arguably be viewed as a claim to a higher level of immediacy. Although I have earlier stated that Crags is an application working within the logic of hypermediacy, the live view feature is the logic of transparent immediacy within hypermediacy; the analogy to the Albertian window as a window onto the world should be apparent.

Following the logic of remediation, new media are initially a repackaging of older media. As media developers (agents of this repackaging), we develop and design on the basis of the existing knowledge and conceptualisations we have. However, these conceptualisations often relate to our understanding of existing media and not the new media. By limiting the idea of a web page to a page in a book, one may fail to exploit the unique capabilities of the new medium. Within the focus of this thesis, I have sought to counteract this by a conscious emphasis on the uniqueness of the medium adapted to. However, as a partially faithful process of adaptation, described as a translucent act of remediation in regards to the original medium (see ch. 3.2), there is always the danger of overlooking completely new ways of presenting information. Landow describes a tendency in media innovation as pouring new wine into old bottles (Landow 2004, p.36). The case of an augmented reality feature replacing the use of topo exemplifies this tendency. The idea emerging from prototyping was to use dynamic markers showing the climbers location on a topo similar to the topo in the guidebook. William's suggestion of live view replaces the topo altogether. The live view aesthetic compared to the topo is radically different, and as such is a step towards pouring new wine into new bottles.

However a live view implementation would have its peculiarities. Besides the battery draining aspect and total reliance of GPS positioning in order to work at all, a live view solution is only capable of displaying what is within view. Conversely, the topo can of course display topographic information independent of your own position. Also, a live view implementation would most probably require additional data gathering by geotagging each route as opposed to the current solution that is geotagging start and end coordinates of a topo. It is therefore questionable how well AR can replace the topos. Undoubtedly, this would be interesting to examine in further iterations of development.

The use of video in Crags is an entirely novel feature to the climbing guide. Because of limited time and the mock-up character of the video implementation, examining the video function was chosen not to be a part of tasks the informants were given. When asked "What do you think about the possibility to watch videos of a route and why?"(q.3.3), all informants saw some value. While Vibeke, Henning and William seemed to be more positive towards having a video function than the others, Kyrre highlighted how a video can inspire one to climb a nice route. Apart from Henning, all informants expressed the aspect of getting beta as a valuable trait of the video function. Also, Christer and Matthew mentioned confirming the right route as a valuable aspect.

Even though videos are not to be found in climbing guides, these guidebooks point to some relevance for the utilisation of videos. In the guide *Fontainebleau Climbs* (Montchaussé, Montchaussé et al. 2001), the use of image sequences are used to represent a specific sequence of climbing with the purpose of giving beta (see appendix 5). By the example of the kineograph (see ch. 2.3.7) and the fact that videos are a series of images displayed by a certain time interval, the close relation between an image sequence and a video should be apparent. Further supported by my informants' response, there seems to be potential for the use of videos.

4.6 Location-Based Services

There are multiple implementations utilising LBS in Crags. The *find me*, *locate* and *closest* function were not an explicit part of the field test and therefore received little mention in the subsequent discussions. However, in assessing the value of the map

view (fig. 9), Christer replied that he liked the *closest* function (q.4.2). Seeing how they are minor helper functions to the map view, I instead put more focus on the more prominent functions utilising LBS, the driving directions and the GPS Locator.

Driving directions

In trying to assess the potential for the driving directions functionality, the informants' replies were unclear. They expressed a medium to low satisfaction with the driving directions implementation (q.2.2). However, when prompted to answer a question of advantages and disadvantages of Crags driving directions compared to the paper-based guidebook (q.2.3), the informants were a lot more positive to the digital option. Statements such as: "Everything is better than in the climbing guidebook, better map and you see where you are"(Kyrre), and "Much easier to know that you are on the right way and close to crag"(Vibeke), seem to point in favour of the digital version. As mentioned earlier, two informants probably failed to use the driving directions function and used the map view of crags instead. Except from William, these informants were seemingly the ones who had the most negative experience with driving directions. Regardless, William was the only one overtly critical of the driving directions, stating "The only thing that crashed! Long detour and difficult to navigate. A lot to improve"(William, q.2.2). However, when asked about advantages and disadvantages, he wrote: "with dynamic maps it [driving directions] can be a lot better than the climbing guide"(William, my brackets). What is interesting is the discrepancy between the informants' satisfaction in using the driving directions in Crags, and their comparative judgement of the quality of driving directions provided by book and iPhone. Admittedly, the reasons for this discrepancy are unclear, and I can only point to some possible factors.

One reason might be that directions given in guidebooks generally are deemed poor and thus not hard to surpass in satisfactory use. Also, as William's reply points towards, design bugs and flaws can contribute to an unsatisfactory experience even though the functional advantages are visible and clear to the user. Thirdly, because hypothetical reflections are more likely to follow a perfect day scenario, conveniently escaping the issues occurring in actual contexts of use, informants might be more positively biased when asked hypothetical questions about potential and limitations, rather than questions which call for reflections of a past use. Lastly, the informants' expectations to a digital direction's aid might be higher than the one they are used to

in a book and as such are subject to a more critical judgement of actual use. When asked about what they thought about the driving directions function, Tobias replied: "Only really useful when it can be used as a real navigation system incl. voice direction etc. Otherwise very hard to use"(Tobias, q.2.2). Instead of comparing Crags to the climbing guidebook, Tobias makes a comparison between Crags and professional navigation systems; this perhaps resulting in a judgement with a higher level of expectancy. In any case, further testing will hopefully clarify the reasons for these somewhat contradicting replies. Undoubtedly, there is room for design improvements, as suggested by the informants. As Henning suggested, it would be advantageous to have the map orientation correspond to the heading of the car, as is usual on GPS systems. Unfortunately this was not an option in the Google Maps API at the time of design, and therefore not implemented.

The want for the modality of sound in the driving directions also shows how not only one unique trait, like the modality of sound or location-based services is employed in the adaptive process, but rather how these traits combined can purposefully be transformed into good user interaction design. For voiced directions, not only is the modality of sound a premise, also hypertext – using Google Maps API for driving directions – and LBS are at work. Another example of such coupling of unique properties is the combining of LBS with the camera feature. As a route can look very different depending what angle the photo is captured from, Matthew suggested that when capturing images they should be geotagged, with the purpose of the climber to easily match picture with route (Matthew, 24:30).

In addition to geotagged images, there were other suggestions for implementation of LBS in Crags. When asked about what functionality they missed in Crags (question 1.8), both Tobias and Matthew wrote they wanted direct guiding to route by GPS. Matthew also stated that compass was a desire. The compass was not a technological feature of my iPhone 3G; it arrived with the later models of the iPhone. Undoubtedly, it would be helpful for several features, e.g. in assisting Google Maps with auto rotating maps in driving directions and for a better calculation[59] of the climber's position when using the GPS Locator.

[59] A compass could be used to determine the angle between climber and wall and possibly better present the climber's position in relation to the wall. Current implementation calculates a 90 degree angle, see also chapter 2.3.3

GPS Locator

The GPS Locator utilises both the multimodal aspect by the use of topos as well as hypertext as a premise for realisation. Nonetheless, it is a function primarily designed to give off location. Therefore I find it fitting to describe it in more detail here.

With the exception of the iPhone 4 used during the test, the devices failed to give off a satisfactory accuracy, and the location update responses from the devices were irregular. The degree of how well the GPS Locator worked was reflected in the informants' response. William, who used the iPhone 4, found the experience of using the topo 'super', and when prompted to reply on positive and/or negative experiences with the GPS Locator, stated: "Extremely pleasant! Much easier to navigate than by using guidebook"(William, q.2.6). Henning, who mostly used a 3GS but also briefly tested the iPhone 4, replied: "Very good experience with 'my' position at the crag"(Henning, q.2.4). He was "positively surprised by accuracy"(Henning, q.2.6) although "sometimes it took some time before current position was updated"(Henning, q.2.5). On the question of how the GPS Locator worked during testing (q.2.5), the informants were given five options ranging from 'very poor' to 'very good'. While Kyrre and Vibeke reported 'poor', Christer and Matthew deemed the experience 'ok' and the remaining responded 'good'. Even though two of the testers found the experience poor, they both saw the potential in having such a function and were positive to the idea. Altogether, there were two reports of large inaccuracy and three mentions of technical issues and delays relating to the continuous updating of current position. In light of these problems, the feedback was surprisingly positive, hopefully not due to novelty but as a genuine appreciation of the GPS Locator's potential.

I have already mentioned how the experience of using the topo was found less satisfying compared to the one in guidebooks. As a counteract measurement to the added difficulty of navigation, the GPS Locator is most prominent. The helpfulness of the GPS Locator was also pointed out by the testers, who upon asked if they found it hard or easy finding a route by using the topo (q 3.5), replied: "It would have been easier if the GPS function had worked properly"(Vibeke), "GPS Locator would be helpful"(Matthew) and "very dependent on the quality of the GPS"(William). Undoubtedly, the issues reported of position update lag and large position inaccuracy during the testing can be fixed in future development. What cannot be fixed is lack of

GPS coverage, and this can occur[60]. Therefore, because the GPS module is very battery intensive, the GPS Locator should be manually controlled to keep the application from draining the battery unbeknownst to the user when the GPS coverage is poor or non-existent. Furthermore, features not dependant on GPS coverage to aid navigation and orientation should be further examined in order to have a well functional application in various conditions of GPS coverage. Such features can for instance include the enhanced touch responsive topo and the option to zoom in on the topo.

During group discussion it emerged how the GPS Locator could be helpful in other contexts of use than the one set up for the field test. Matthew pointed out how the function would be very helpful for bouldering (Matthew, 38:20). As the name implies bouldering is a climbing style that involves climbing on boulders. Compared to sport climbing crags, bouldering areas consist of boulders with climbing routes[61] instead of the larger rock formations used for sport climbing. Due to the fact that boulders are scattered within a larger geographical area than the crags for sport climbing, and because boulders are less visible than larger rock faces in the landscape, the helpfulness of LBS are quite possibly even greater for this climbing style.

[60] For instance, a field trip to the crag Fjell (59.78441, 10.9436), revealed that there was no coverage of GPS, 3G/EDGE and GSM.
[61] See for instance http://www.stangebuldring.no/ for an example of bouldering. The mentioned website's inclusion of GPS coordinates on its route information arguably supports the relevance of having a GPS implementation for bouldering in a digital climbing guide like Crags

5 Conclusions

The focus in this thesis was to examine the potential of the unique properties of a medium in the context of an adaptation. Examining potential is not something easily summarised in a quantifiable manner. The answer to the question of what potential lies in the unique properties can be read in several ways. One method is simply to see which implementations were favoured, such as the camera feature and the GPS Locator in this context. Another is to examine exactly what motivates the appeal of these implementations and use this as a working hypothesis for other possible implementations. For instance, if the greatest appeal with the camera feature is that images in a climbing guide can become personal, the personalising aspect should perhaps be used and realised through other features as well. A third way to answer the question of potential is through theory. By highlighting the properties in question through theory, the rhetorical potential can be revealed. One example is to contextualise multimodality through the theory of remediation; this enables us as designers to understand why increased multimodality is perceived to be better. Such insights may be beneficially used to inform design.

The rest of this chapter will be used to highlight selected findings in each of my focus areas – hypertext, multimodality and location-based services – before I outline the wider relevance of the thesis, its limitations and some suggestions for further development of Crags.

5.1 Hypertext

In this thesis, the perspective on hypertext has been twofold. Firstly I have focused on the hypertext as a structure that is different from the linear structure of a book. Secondly, since the hypertext is generally realised in digital environments and books are not, the dynamic qualities of the hypertext are regarded as a trait to the hypertext in this context of adaptation.

My focus on the structure was again twofold. Firstly, I tried to assess some general potential of the hypertext as a reading structure by interpretation of my informants' responses. This pointed towards a desire for extended hypertextual linking with the aim to create more efficient ways of navigation within the hypertext. I also identified

two places where navigating the hypertext was found difficult – both related to the topo – and suggested options to solve these difficulties. Secondly, by identifying a similarity between the geospatial orientation that occurs in climbing and how hypertexts are analogous to reading landscapes, I tried to uncover potential inherent to this analogy. The feedback provided suggests the analogy of moving in landscapes has its relevance whenever geospatial orientation is required. Moreover, linear representations of information were preferred whenever geospatial orientation is not required. The reasons for this preference are neither clear nor exhaustive. However, indications points towards lower cognitive effort in linear readings as a key factor. Even so, a mix of linear and landscape representations seems preferential and should be deliberately employed in the hypertext.

Focusing on the dynamic qualities of the hypertext revealed findings for wanted features I will not list again, as they are thoroughly presented in the previous chapter. Among the most prominent were features relating to personalisation of content, syndication of content from other information providers and the ease of which the same information can be presented in different ways and places throughout the hypertext. Furthermore, the implications stemming from the dynamic quality of adding and changing content extends beyond the application and the user experience. The option to add content with ease directly affects the possible pricing and distribution models for a commercial release of the climbing guide application. The preferred model of paying per crag enables a pay-for-what-you-need distribution model that accommodates climbers' preferences, and also makes it easy to monitor and direct money back to the club maintaining the crag in question. The option to change content makes it possible to utilise climbers as contributors of information and as such, can be helpful for one of the most focused on areas in the climbing community; ensuring the climber's safety.

5.2 Multimodality and Location-based Services

The investigation of multimodal potential in Crags has been subject to mainly three areas of focus: the use of photos, videos and the topo. In this context, the camera feature was the most appreciated. Video was found useful for referential (beta) and inspirational purposes. However, more extensive testing of use and of video capturing of will provide more data on its potential. Lastly, the implementation of the

topo was assessed through testing. For an effective reading of the topo, issues related to the display size were identified and subsequent counter measurements have been suggested for further development.

Assessing the potential of LBS has been done mainly through testing of the driving directions and GPS Locator functionality. The driving directions' function received contradicting feedback that hopefully can be clarified in further tests. The GPS Locator was found at great help for reading the topo. Using LBS to be positioned within the topo means it is also to be positioned within the hypertext. The liking of this feature is supporting the argument that low cognitive effort and effectiveness are appreciated criteria for a good user experience.

5.3 Wider relevance

In searching for the potential of the unique properties of the medium for this thesis, I found out that the most interesting, innovative and successful implementations were based on a composite of these properties. For instance, the GPS Locator makes use of images, LBS and hypertext in order to create an aesthetic different from the paper-based topo. Because location is not presented numerically but is instead presented visually in concoction with the topo, the reading of location becomes embedded within the image. Perceptively, the topo is location responsive, as if location is a modality of the digital topo. So it seems the coupling of unique properties is a breeding ground for innovative aesthetics, and this acknowledgement can be and should be utilised in the processes of design.

The personal experience of the synthetic/analytic process of this thesis has made clearer to me the dynamics of theory and practice in this process. In this project, the advantage of making use of practical theoretical concepts like activity theory in the design process is obvious. However, the advantage of utilising non-practical theory is not so clear. In the different stages of development, the human agent as the designer is arguably the most central source of creativity. Design ultimately originates from our thoughts and ideas, is then realised through prototypes and ends in the final design product. As a set of metaphors, specific conceptualisations shape our thoughts, ideas and subsequently our design, such as the conceptualising of hypertext

as a landscape provides an example of. In this way, non-practical theory also affects design, hopefully to the benefit of the final design product.

The contributing factor of design to theory is a different case. An obvious contribution would be to generate a more high-level abstract model or framework from which others could employ in the design process. However, this has not been an aim for this thesis. The design object is subject to a set of specifics: a specific design and a specific use. Furthermore, the qualitative means through which knowledge are acquired is not preferred to produce external generalizability. These factors make this academic endeavour subject to user generalizability or case-to-case transfer where readers themselves determine to which degree material from another study is applicable to their own context (Merriam 2002, p.28). This thesis is thus shaped and should correspondingly be read as what is commonly termed a *thick description*, where knowledge are presented on the basis of sufficient detailing a phenomenon (Lincoln and Guba 1985, p.124).

5.4 Limitations

Having more than one field test would have provided a more solid foundation for interpreting functionality. Data from each test could have been examined against each other in order to identify and account for bias subject to the conditions of the particular field test. Also, using different testers for each test would have helped counter personal bias from the informants in their responses.

Assessing thought modes is a complicated task. The structures and logic of how we think is a complex matter, upon which this thesis has a slim chance of asserting big questions with absolute certainty. In hindsight, my efforts to evaluate mode of thought would have benefitted from more data, stemming from additional investigations in the questionnaire and focus groups.

5.5 The Climb Ahead

Conclusively, I will make some general recommendations for further development of Crags. Extended hypertextual navigation should be utilised. Various ways of positioning the climber by the use of LBS should be developed. In this context, ways of using the compass and accelerometer should be further explored. The (re)use of

images and video at various places in the applications should be considered. The option for user feedback should be widened to include other objects than photos and videos, such as the option to comment on routes. Last and perhaps most importantly, solutions to provide better user interaction with the topo should be sought.

As these recommendations show, the unique properties of the medium should be actively and prominently involved. Not for the sake of novelty, but in order to create an application with functional appeal. Climbing is but one area of life where the digital texts are making their entrance. Most probably, they will not turn around and leave us, at least not in the near future. Therefore, we must continue to play with, examine and investigate the building blocks of our digital texts, thus improve them to be as good as they can be.

Resources

Crags desktop interface for browsing and input of data:
http://mikkelstaff.net/cps/web

Crags application:
http://mikkelstaff.net/cps/app
(please note that functionality is reduced on a desktop browser)

Data from user test

Questionnaire response transcribed:
http://mikkelstaff.net/resources/questionnnaire_response.pdf

Group discussion Henning, Christer and Vibeke:
http://mikkelstaff.net/resources/group1.m4a

Group discussion group Kyrre, Matthew and Tobias:
http://mikkelstaff.net/resources/group2.m4a

Group discussion group all:
http://mikkelstaff.net/resources/discussion_all.m4a

Group discussions and questionnaire response transcribed and treated:
http://mikkelstaff.net/resources/user_data.xlsb

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Appendix 1: E-mail correspondence with Jay Taylor

(Presented in chronologically reversed order)

Hi Mikkel,

Published route descriptions effectively began with the first published stories about climbs. The Alpine Club's *Peaks, Passes, and Glaciers* in the late 1850s evolved into the *Alpine Journal*, and each essay was a sort of route description. These of course became more formalized over time, but I couldn't tell you when the first guidebook was actually published in Europe. I know that Willo Welzenbach is generally credited for coming up with the first formal rating system. I think therein lies a larger clue, because Welzenbach and other Germanic eastern Alp climbers were far more modernist than the English and French about these issues and, as a result, innovated a lot of the technical aspects (rappels, aid climbing, rating systems, so on). One additional author worth examining if you can read German is Ranier Amstädter. Perhaps he as well as Hoiban might give you a firmer sense of dates. Your plowing ground that remained mostly untouched in my studies.

- Jay.

- Joseph E. Taylor III.
Departments of History and Geography
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taylorj@sfu.ca
http://www.sfu.ca/~taylorj/

On Sep 7, 2010, at 10:37 AM, Mikkel Staff wrote:
Dear Jay,

Thank you for your reply! I understand that the historic landscape is a bit more foggy to me than I first thought (as often happens, sadly). Let me be brief and explain my situation, and hopefully you can give me a quick reply. My master thesis has little historic focus, what is of it is to give a background information of *cliimbing guide books*. As there apparently are a lot of disjunctures in the evolution of mountaineering, it might be hard to give a streamlined backdrop as I had first imagined. However, I think and hope that the next best thing I can do to provide some insight to the reader, is to describe some key events that has lead to the status of climbing guide books today. Perhaps it is suffcient to describe key events within climbing and mountaineering, like for instance the formation of the clubs and the establishing of climbing as a sport. Furthermore, since *the book* is what is given the background on in the thesis, I need to attach some key events to the guide book. So, one easy question, that maybe isn't that easy to answer: When was the first climbing guide books with route descriptions was published?

Do you have any idea on this?

thank you for your time, very much appreciated!

Mikkel

On Aug 31, 2010, at 17:10 , Taylor Joseph wrote:
Dear Mr. Staff,

This is an interesting convergence of avocational, entrepreneurial, and academic threads. My gut reaction is that your basic thesis is not quite sustainable. Historically speaking, there are

a lot of disjunctures in the evolution of modern mountaineering. Local guides did open many routes and were indeed the repositories of much alpine lore and geographical information, especially in places like Chamonix and Zermatt. However, amateur clubs also generated and hoarded much information as well. Peter Holger Hansen's Harvard dissertation ("The History of British Mountaineering," 1991) is the best treatment I've found of sussing the cultural underpinnings of the early sport from the perspective of its most important progenitor of rules and customs: the Alpine Club of London. Similarly, Olivier Hoiban's *Les Alpinistes en France* (Paris, 2000) offers a strong interpretation of the internal tensions of French sport. I'm sorry to say that I do not know the Germanic literature well at all, but a colleague here in the states named Kerwin Klein is beginning to publish on the history of the eastern Alps and is finding a similarly fractured tale of evolution. Thus I think it will be hard to find a single "line . . . back to early cartography and the use of local guides." In the case of the early topos drawn for Yosemite Valley routes, for example, the evidence such as it is suggests that Richard Leonard may have been influenced by earlier line drawings of mountain routes, but the pitch-by-pitch detailing of the route and his inclusion of data on piton placements seems wholly novel, perhaps a truly organic development unique to Yosemite, although I hardly have the broad reading to make such a claim definitively. If you're interested in these documents, I suggest you contact Ken Yager at the Yosemite Climbing Association (http://www.yosemiteclimbing.org/). There are indeed lines connecting some developments, but there are also disjunctures and, perhaps, wholly novel developments as well. In any case, I wish you luck, and feel free to contact me if you have other questions.

- Jay Taylor.

- Joseph E. Taylor III.
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taylorj@sfu.ca
http://www.sfu.ca/~taylorj/

On Aug 31, 2010, at 2:46 AM, Mikkel Staff wrote:
Hi,

I am contacting you by suggestion of Armando Menocal, after e-mail correspondance with him last week. I hope you have the time to read and reply to this e-mail. This is the case:

I am a norwegian student who is writing a master thesis in media science, which examines the potential of electronic climbing guides. More specifically I am investigating how certain properties like location based services and hypertextual structure can potentially enhance the user experience of climbing guides/topos. I have done this through prototyping an electronic guide book on a mobile device, and are hoping to find some interesting findings through yet-to-be-done user testing and user surveys. In this matter I am searching for some background information for my thesis, on the history of climbing guide books, particurarly the incorporation of maps/topos in these books.

Often I find it somewhat difficult to trace a specific origin to a tradition, as there are several factors involved. For instance in this case, I am looking for the origin of use of climbing guide books and by extension their use of topographic route descriptions. I imagine (don't know though, hence this request) a line can be drawn both back to early cartography and the use of local guides (guide as in a person) in the swiss Alps back in the 1850's, with knowledge on weather conditions, easiest way up to the saddle between those peaks, and the later training of these locals to assist in mountaineering. Just before contacting Mr. Menocal, I came across your article "Mapping adventure: a historical geography of Yosemite Valley climbing landscapes". It gives a very detailed description of the use of topographic maps, but there is little reference to any activity outside the US (an exception being the caption to the image

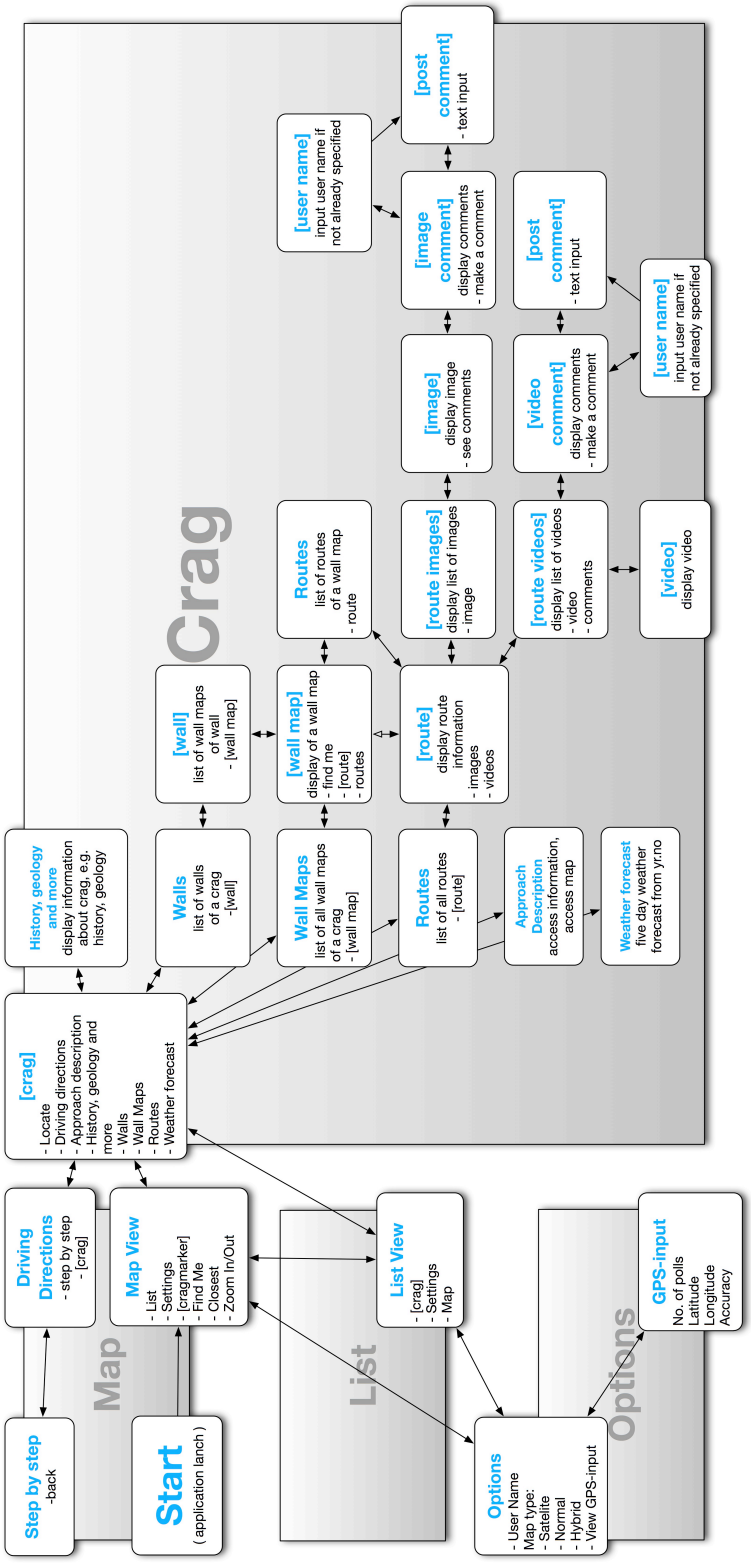
used in *American Alpine Journal 1* (1931), from Mt. Ushba). In searching for background information on topos I want to put it in global perspective, and so far there does not seem to be an awful lot of literature on the subject. It seems that AAC has an extensive library that would be very interesting for further examination and enlightenment, unfortuneately I am located in Oslo, Norway, quite far away, it is a long and somewhat expensive trip to the library.

I was hoping, since you have done extensive work on this subject, that you might be able to assist me either in finding sources that I can use as a reference. Or, if you could provide any information on this, using e-mail correspondance with you as a subject authority for reference in my thesis would be extremely helpful. Hoping for a positive reply!

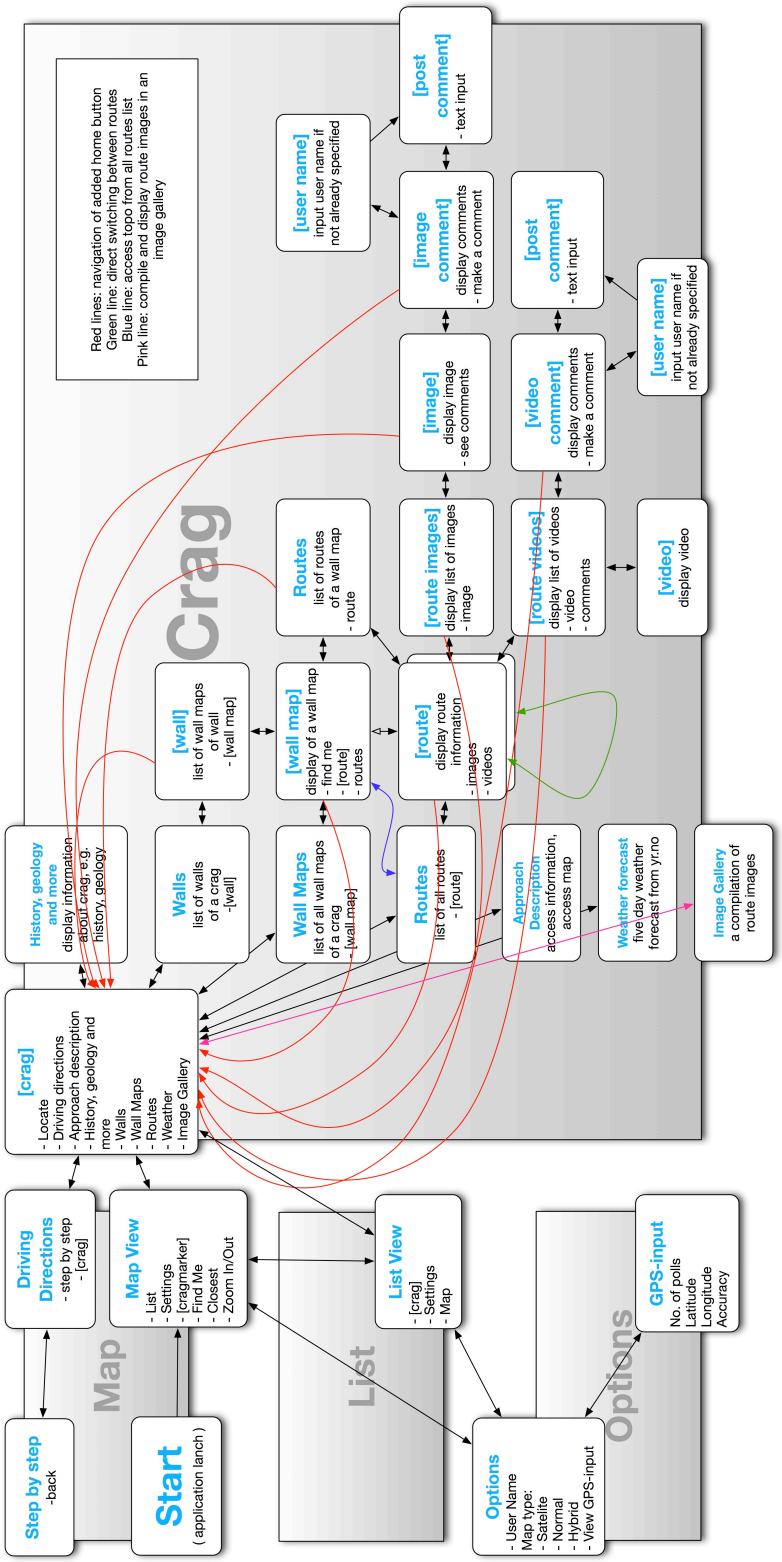
Sincerely,

Mikkel Winsvold Staff
mikkel.staff@gmail.com

Appendix 2: Hypertextual navigation in Crags



Appendix 3: Added hypertextual navigation in Crags



Appendix 4: Print medium: advantages and disadvantages

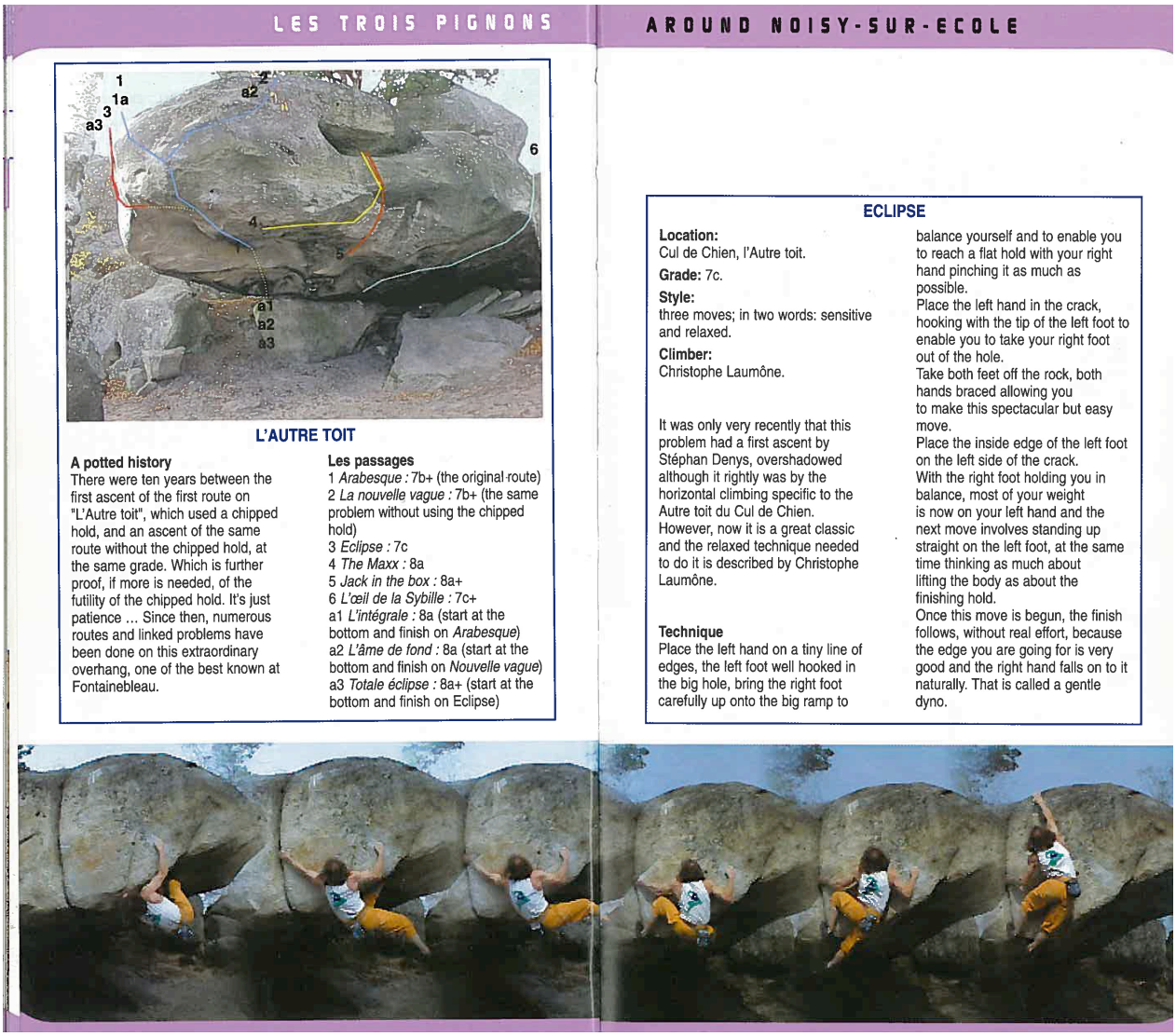
(from the article *Reading and Writing the Electronic Book* by Nicole Yankelovich, Norman Meyrowitz and Andries van Dam, in the book *Hypermedia and Literary Studies* by Paul Delaney and George P. Landow)

CHARACTERISTIC	ADVANTAGES	DISADVANTAGES
Integrity of information	Historical value Never inaccessible because of unreliable hardware	Readers can never alter content Readers cannot customize information Cannot conform to user preferences (e.g. type size, margin width)
Physical entities	Portable Allows browsing and exploring Allows annotation and underlining Aesthetically appealing	Limited to 2-D information Limited to static text and graphics Costly to reproduce for quickly outdated information Often hard to locate specific information
Static		Cannot handle sound or motion Difficult to create multiple indices
Advanced technology	Well-defined and accepted standards Typography, graphic design, and photo reproduction refined fields High-resolution print and graphics Easy to read	Joint authorship difficult Re-keying text is error-prone

Table 1. Print medium: advantages and disadvantages

Appendix 5: Image sequences in a climbing guide

(from the bouldering guide *Fontainebleau Climbs – The finest bouldering and circuits* by Jo & Francoise Montchaussé and Jacky Godoffe)



LES TROIS PIGNONS

L'AUTRE TOIT

A potted history
There were ten years between the first ascent of the first route on "L'Autre toit", which used a chipped hold, and an ascent of the same route without the chipped hold, at the same grade. Which is further proof, if more is needed, of the futility of the chipped hold. It's just patience ... Since then, numerous routes and linked problems have been done on this extraordinary overhang, one of the best known at Fontainebleau.

Les passages
1 *Arabesque :* 7b+ (the original route)
2 *La nouvelle vague :* 7b+ (the same problem without using the chipped hold)
3 *Eclipse :* 7c
4 *The Maxx :* 8a
5 *Jack in the box :* 8a+
6 *L'œil de la Sybille :* 7c+
a1 *L'intégrale :* 8a (start at the bottom and finish on *Arabesque*)
a2 *L'âme de fond :* 8a (start at the bottom and finish on *Nouvelle vague*)
a3 *Totale éclipse :* 8a+ (start at the bottom and finish on Eclipse)

AROUND NOISY-SUR-ECOLE

ECLIPSE

Location:
Cul de Chien, l'Autre toit.

Grade: 7c.

Style:
three moves; in two words: sensitive and relaxed.

Climber:
Christophe Laumône.

It was only very recently that this problem had a first ascent by Stéphan Denys, overshadowed although it rightly was by the horizontal climbing specific to the Autre toit du Cul de Chien. However, now it is a great classic and the relaxed technique needed to do it is described by Christophe Laumône.

Technique
Place the left hand on a tiny line of edges, the left foot well hooked in the big hole, bring the right foot carefully up onto the big ramp to balance yourself and to enable you to reach a flat hold with your right hand pinching it as much as possible.
Place the left hand in the crack, hooking with the tip of the left foot to enable you to take your right foot out of the hole.
Take both feet off the rock, both hands braced allowing you to make this spectacular but easy move.
Place the inside edge of the left foot on the left side of the crack.
With the right foot holding you in balance, most of your weight is now on your left hand and the next move involves standing up straight on the left foot, at the same time thinking as much about lifting the body as about the finishing hold.
Once this move is begun, the finish follows, without real effort, because the edge you are going for is very good and the right hand falls on to it naturally. That is called a gentle dyno.

)F YOUR DREAMS ... EXTREMES OF YOUR DREAMS ...

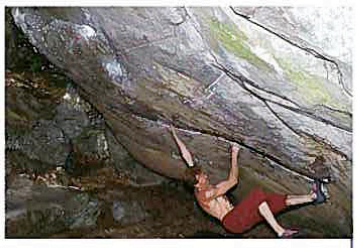
earlier than a century old, so it seems appropriate to give a of the routes which were landmarks of their time. Since the first done in the second decade of the last century, standards have y pushed forward until today we are on the verge of grade nine. tedly see the breakthrough into that grade this century. rately ruled out any idea of an exhaustive catalogue (there are dred boulders recorded within the grades we have listed) and st quality routes.
ne threshold for extreme climbing at the portals of 7c because it the gap between 7b and 7c which is the determining factor in or to the highest level of climbing.
problems, we use grades which have been the subject of wide d reflect as far as possible the true grade of the climbs. In some mentioned the existence of a variation to a problem where the icularly outstanding. The variation may alter the grade up or se may be.
'ange naïf in area 95.2 of the forest goes at 7c+, which was the f the problem, but there is a 7a+ variation using other holds, ole overleaf is marked as V7a+.

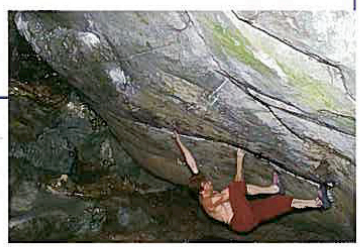
nents of the century:
the first grade four, at Bas Cuvier
Allain,the first
Cuvier Rempart
se, the first
as Cuvier
, the upper
six, at Bas

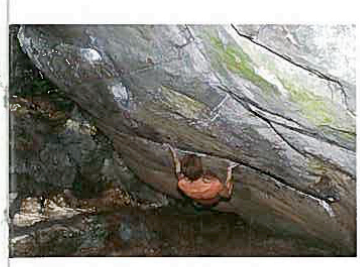
r, the first grade
Cuvier
lésina, the
grade seven at

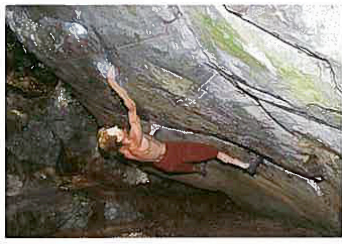
emain, the first
Cuvier Rempart
s confirmed as
rade for
highest level.

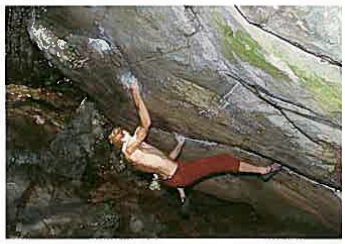
ale, an 8b in

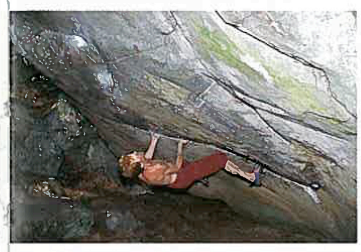


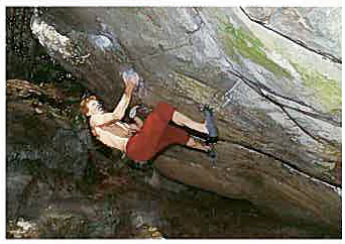


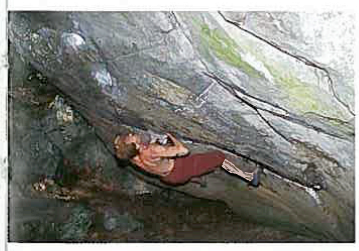


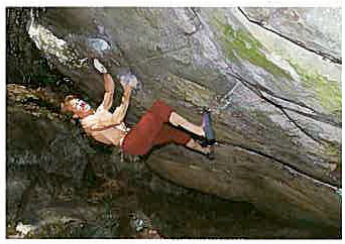




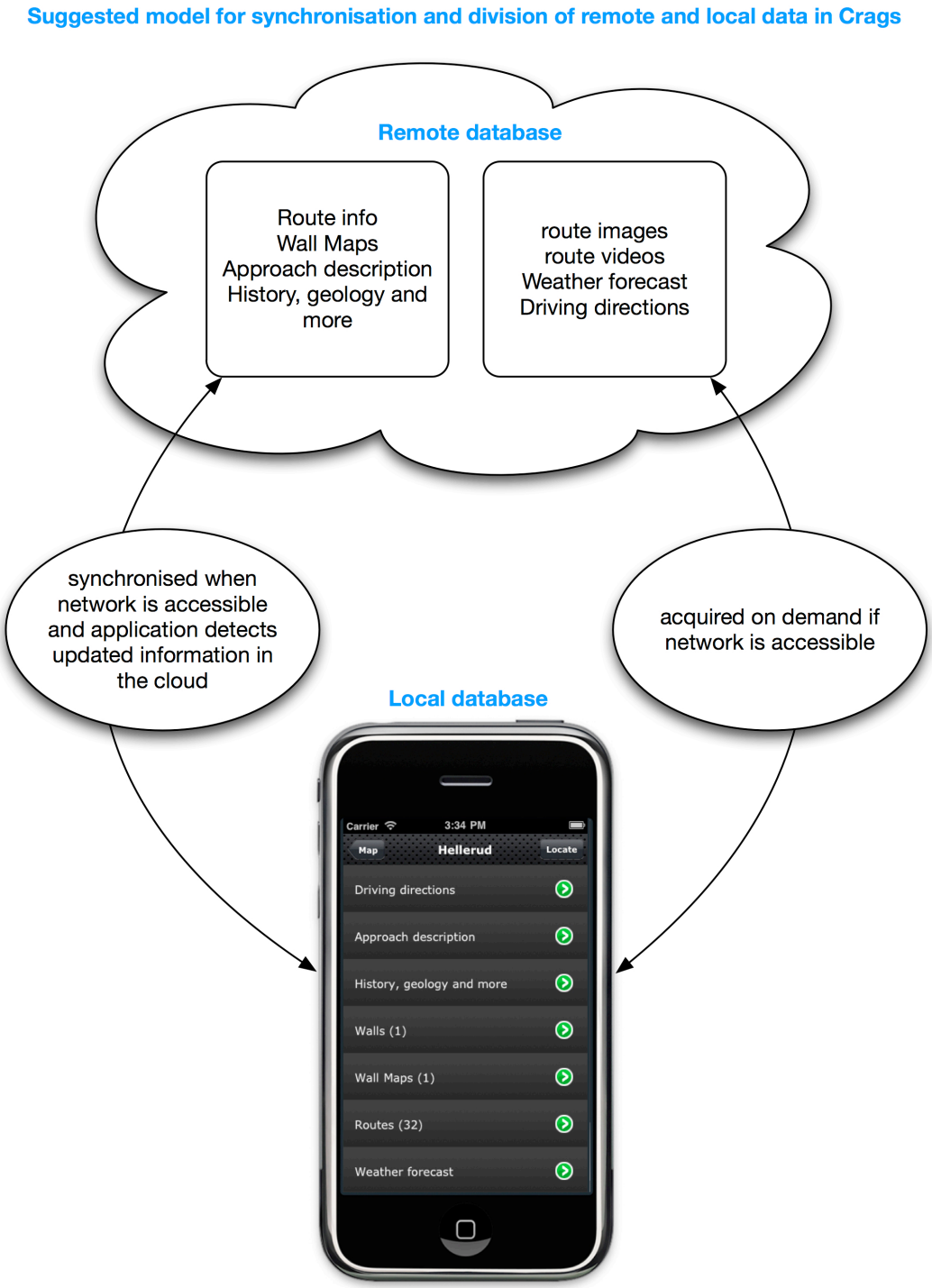








Appendix 6: Local/Remote database model



Appendix 7: Questionnaire from user test

Glossary:

Topo: wall map, image of the climbing wall with routes drawn on to them
Climbing guide: a guide book for climbers(e.g. *Drammensgranitt* or *Klatreperler*)
Crags: The application you just tested, a prototype of a digital climbing guide

1.1 Male: _____ Female: _____ Age: _____

1.2. How much experience do you have with the use of climbing guides?

☐ None ☐ A little ☐ Some ☐ A lot

1.3. How much experience do you have with smartphones with touch sensitive screen?

☐ None ☐ A little ☐ Some ☐ A lot

1.4 In what different situations do you usually use a climbing guide? (e.g. what places, for what purpose)

_____

_____

_____

1.5. What did you like best with Crags? (one or more aspects)

_____

_____

_____

1.6. What did you like the least about Crags? (one or more aspects)

_____

_____

_____

1.7 Did the application crash while you were using it?

☐ No ☐ Yes if, yes, where:

_____

_____

_____

1.8 What functionality do you miss in Crags?

_____

_____

_____

1.9 How did you experience using Crags?

_____

_____

_____

_____

_____

_____

2.1 How did you use the application to find your way to the crag?

_____

_____

_____

2.2 What do you think about the driving directions function?

_____

_____

_____

2.3 What advantages and disadvantages do you think the driving directions function in the application has compared to what you are used to in a climbing guide?

_____

_____

_____

2.4 How was the experience of using the topo?

_____

_____

_____

2.5 In the application there is a function (GPS Locator) that shows you your position on the topo. How did that work?

☐ Very poorly ☐ Poor ☐ Ok ☐ Good ☐ Very good

(comment):_____

_____

_____

2.6 What positive and/or negative experiences did ”GPS Locator” give you?

_____

_____

_____

3.1 What do you think about the possibility of adding pictures to a route?

_____

_____

_____

3.2 What value/use do you see in the option to view images of a route?

_____

_____

_____

3.3 Hva do you think about the possibility to watch videos of a route and why?

_____

_____

_____

_____

3.4 What do you think about the option to comment on pictures and videos?

_____

_____

_____

3.5 Did you find it hard or easy finding a route by using the topo?

(1: Easy - 10: Hard): _____

Comment:

_____

_____

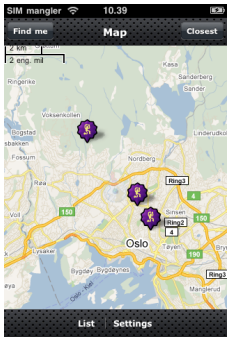
_____

4.1 How was your experience of navigating and orientating yourself between different crags in the application?

_____

_____

_____



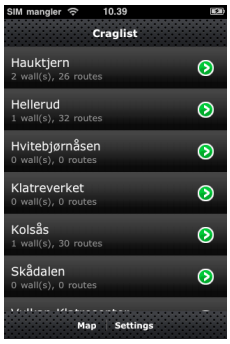
4.2. What is your opinion of the use value of different crags displayed as a map in the application?

_____

_____

_____

_____



4.3. What is your opinion of the use value of different crags displayed as a list in the application?

_____

_____

_____

_____

4.4 Can you imagine situations where you prefer using map view or list view of crags, if so what situations are that?

_____

_____

_____

_____

_____

4.5 To what extent (1-10) did you find the navigation within a crag intuitive?

(1: Incomprehensible - 10: Easy to grasp): _____

Comment:

_____

_____

_____

_____

4.6 Navigating back and forth between topo and route information, to what extent was this easy?

☐ Incomprehensible ☐ Difficult ☐ Confusing ☐ Ok ☐ Easy

Comment:

_____

_____

_____

4.7 What positive/negative experiences did you have with the weather forecast service implemented?

_____

_____

_____

5.1 Would you buy a climbing guide (book) if you had the iPhone version? Or when would skip buying the book, and when would you have both?

_____

_____

_____

5.2 Would you buy the iPhone climbing guide if you had the climbing guide (book) from before?

_____

_____

_____

5.3 What would you be willing to pay for a iPhone climbing guide if it covered all crags in the country?

_____

5.4 What would you be willing to pay or a iPhone climbing guide if it covered the same geographical area as the climbing guide book? (e.g. *Drammensgranitt*)

_____

5.5 What in your opinion is the biggest *positive* aspect of using Crags instead of a climbing guidebook?

_____

_____

_____

5.6 What in your opinion is the biggest *negative* aspect of using Crags instead of a climbing guidebook?

_____

_____

_____

5.7 If you were to use Crags, do you think you would use it alone or as a supplement to a climbing guidebook?

_____

_____

_____

5.7 b) Or, in what situations would you use Crags alone, and when would you use it together with a climbing guide?

_____

_____

_____

5.8 Do you think it is harder or easier to use the topo in Crags compared to a climbing guide?

5.8 b) to what extent?

☐ A lot ☐ Some ☐ Marginal or: ☐ Same

Comment:_____

_____

_____

5.9 Do you think it was easier or harder to find information in Crags vs. finding information in a climbing guide book?

Harder / Easier ☐ A lot ☐ Some ☐ Marginal or: ☐ same

Appendix 8: Preliminary group discussion

Questions

English:

Question 1: What can be done to improve the navigation in the application?

Question 2: What other functions do you wish was included?

Question 3: How did the use of GPS in the application work (driving directions and topo)?

Norwegian:

Spørsmål 1: Hva kan gjøres for å forbedre navigeringen I programmet?

Spørsmål 2: Hvilke andre funksjoner skulle du ønske var med?

Spørsmål 3: Hvordan fungerte broken av GPS i programmet (veibeskrivelser og veggkart)